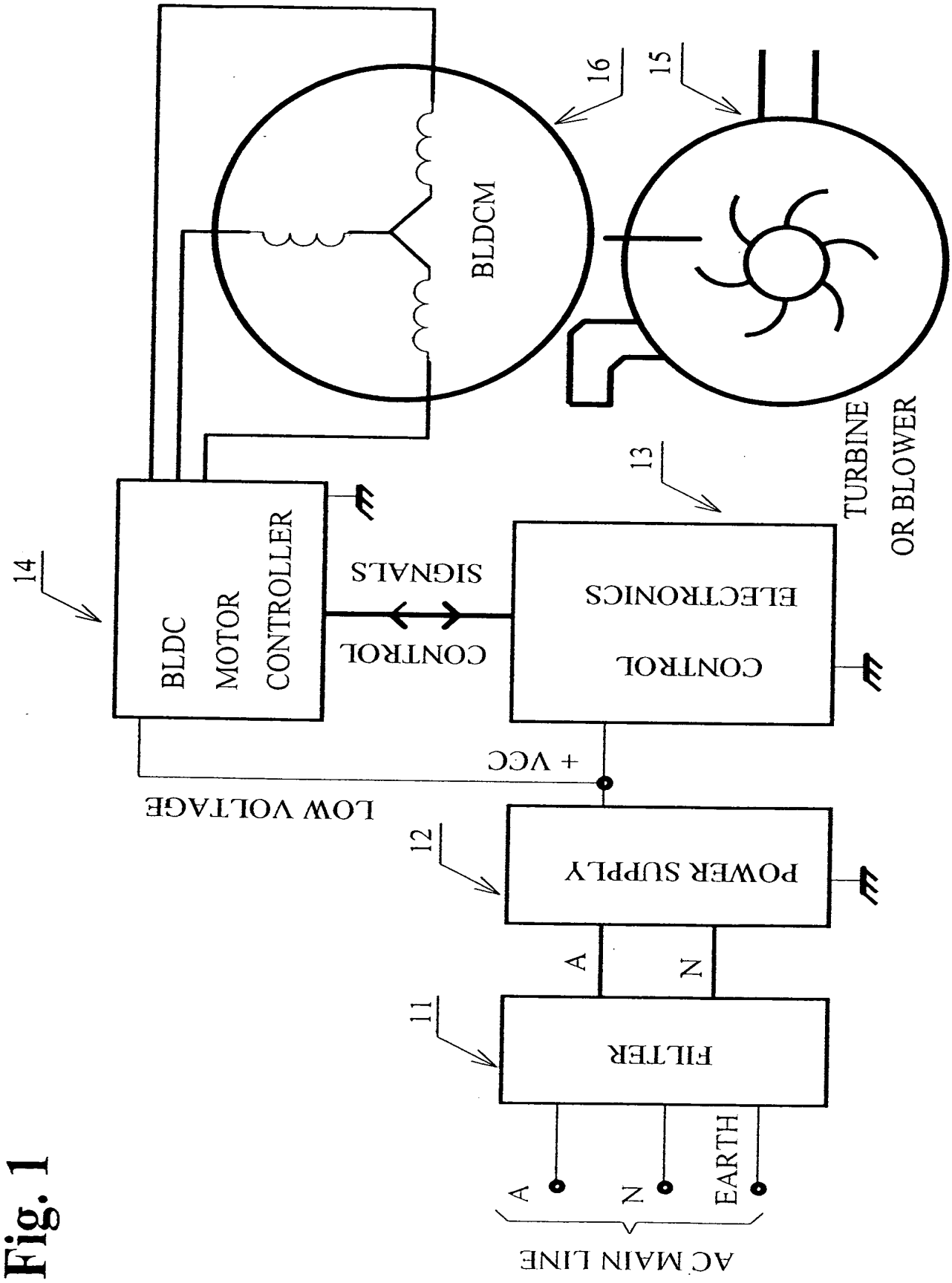
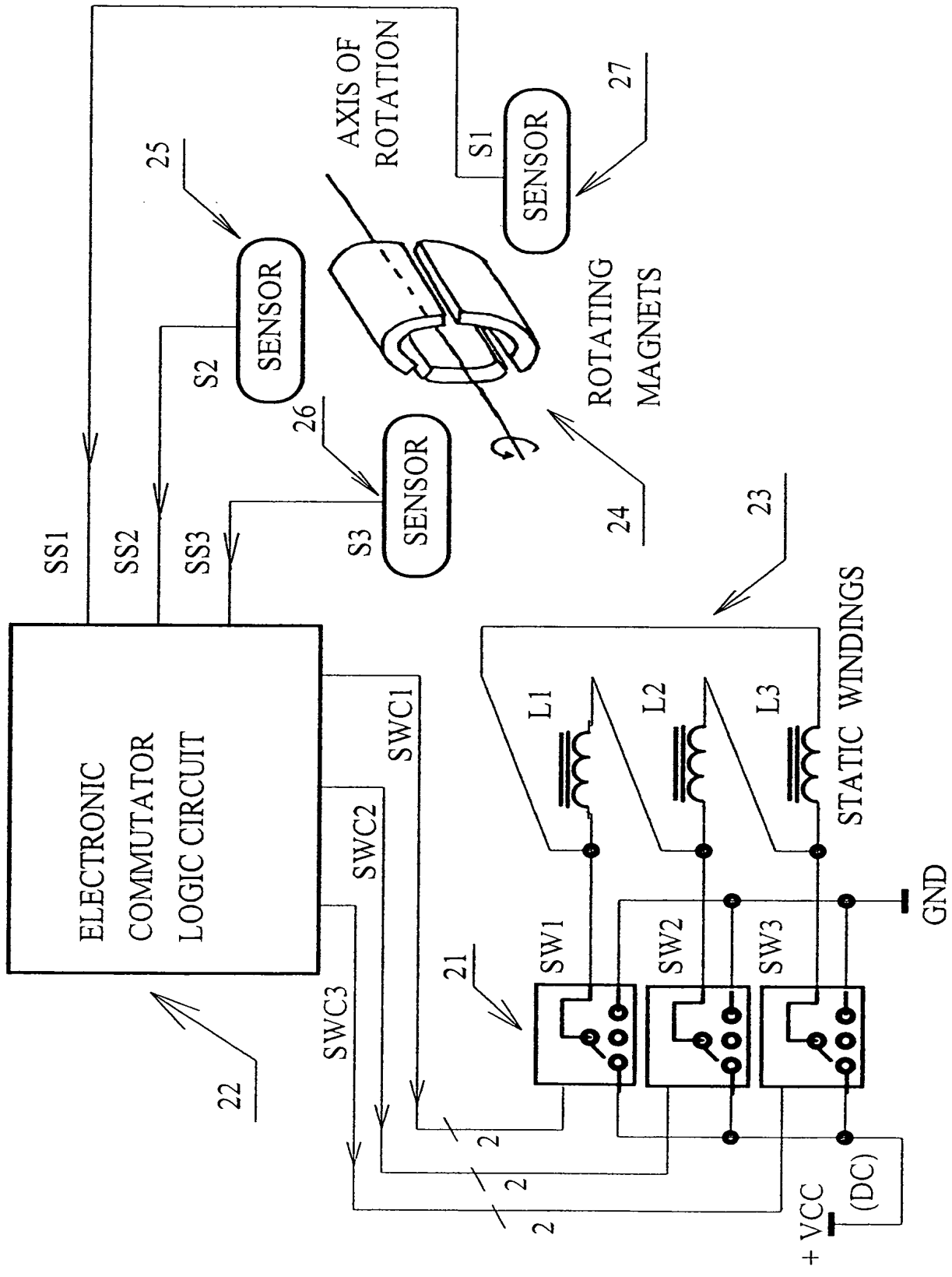

16
15
BLDCM
TURBINE
OR BLOWER
13
14
BLDC
MOTOR
CONTROLLER
SIGNALS
CONTROL
ELECTRONICS
CONTROL
+ VCC
LOW VOLTAGE
12
POWER SUPPLY
A
N
11
FILTER
A
N
EARTH
AC MAIN LINE

Fig. 1

Fig. 2


ELECTRONIC COMMUTATOR LOGIC CIRCUIT
22
SS1
SS2
SS3
SWC1
SWC2
SWC3
SENSOR
25
S2
SENSOR
26
S3
SENSOR
27
S1
AXIS OF ROTATION
ROTATING MAGNETS
24
23
STATIC WINDINGS
L1
L2
L3
21
SW1
SW2
SW3
GND
+ VCC (DC)
2
2
2

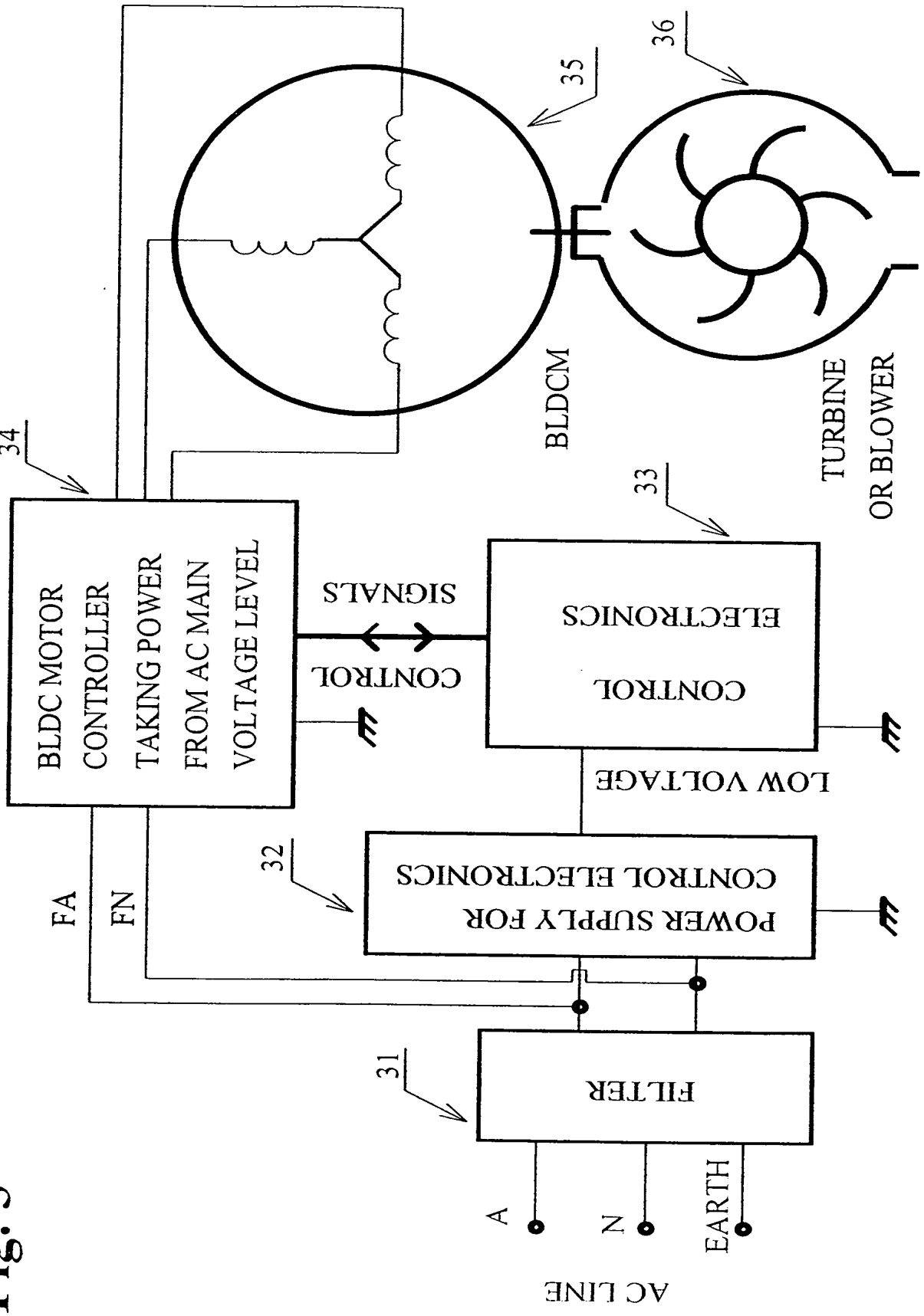

AC LINE
A
N
EARTH
31
FILTER
32
POWER SUPPLY FOR CONTROL ELECTRONICS
FA
FN
LOW VOLTAGE
33
CONTROL ELECTRONICS
SIGNALS
CONTROL
34
BLDC MOTOR CONTROLLER TAKING POWER FROM AC MAIN VOLTAGE LEVEL
BLDCM
35
TURBINE OR BLOWER
36

Fig. 3

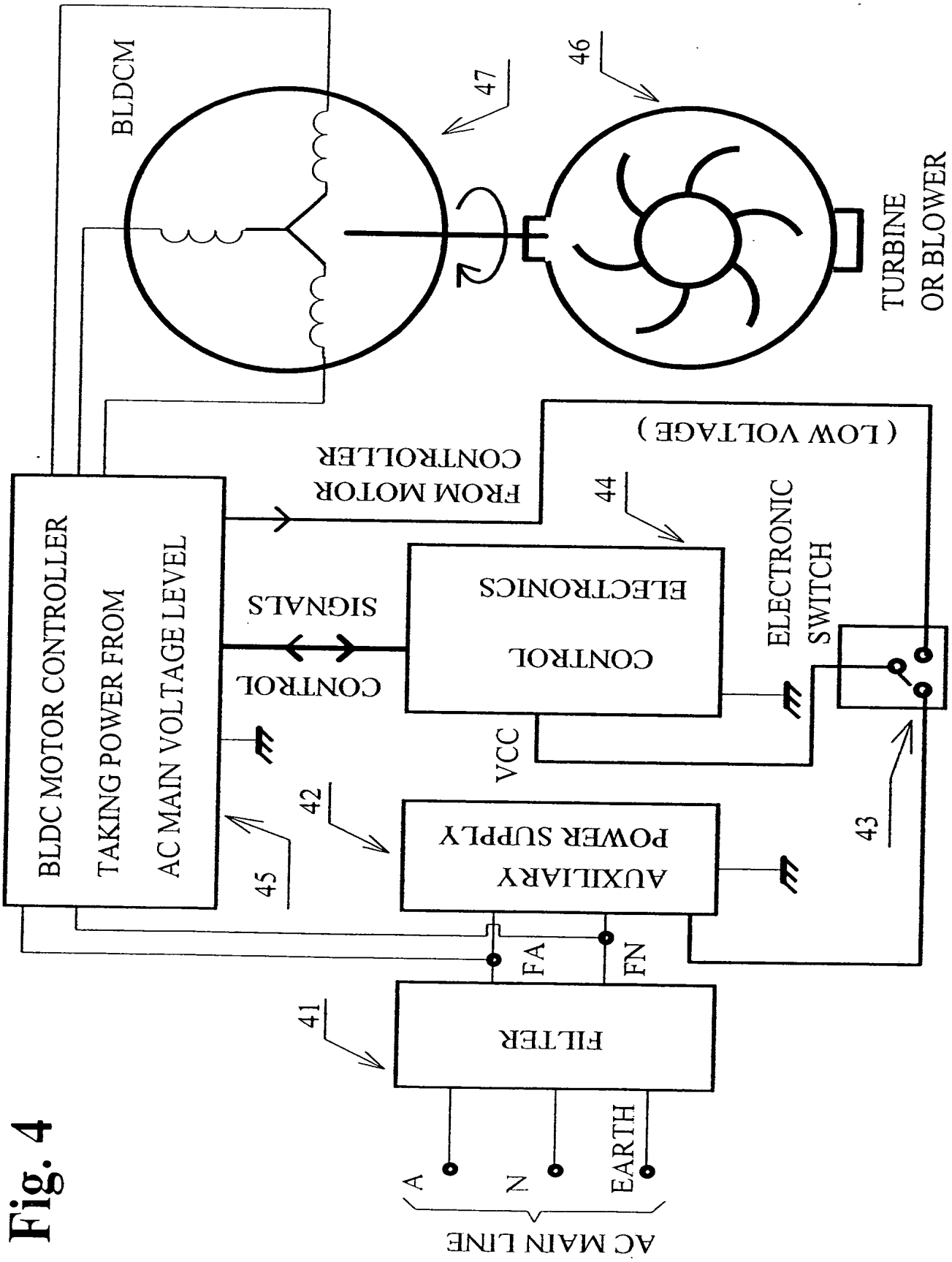

BLDCM
47
46
TURBINE
OR BLOWER
(LOW VOLTAGE)
FROM MOTOR
CONTROLLER
44
ELECTRONIC
SWITCH
BLDC MOTOR CONTROLLER
TAKING POWER FROM
AC MAIN VOLTAGE LEVEL
SIGNALS
CONTROL
ELECTRONICS
CONTROL
VCC
42
AUXILIARY
POWER SUPPLY
43
45
FA
FN
41
FILTER
A
N
EARTH
AC MAIN LINE

Fig. 4

Fig. 5

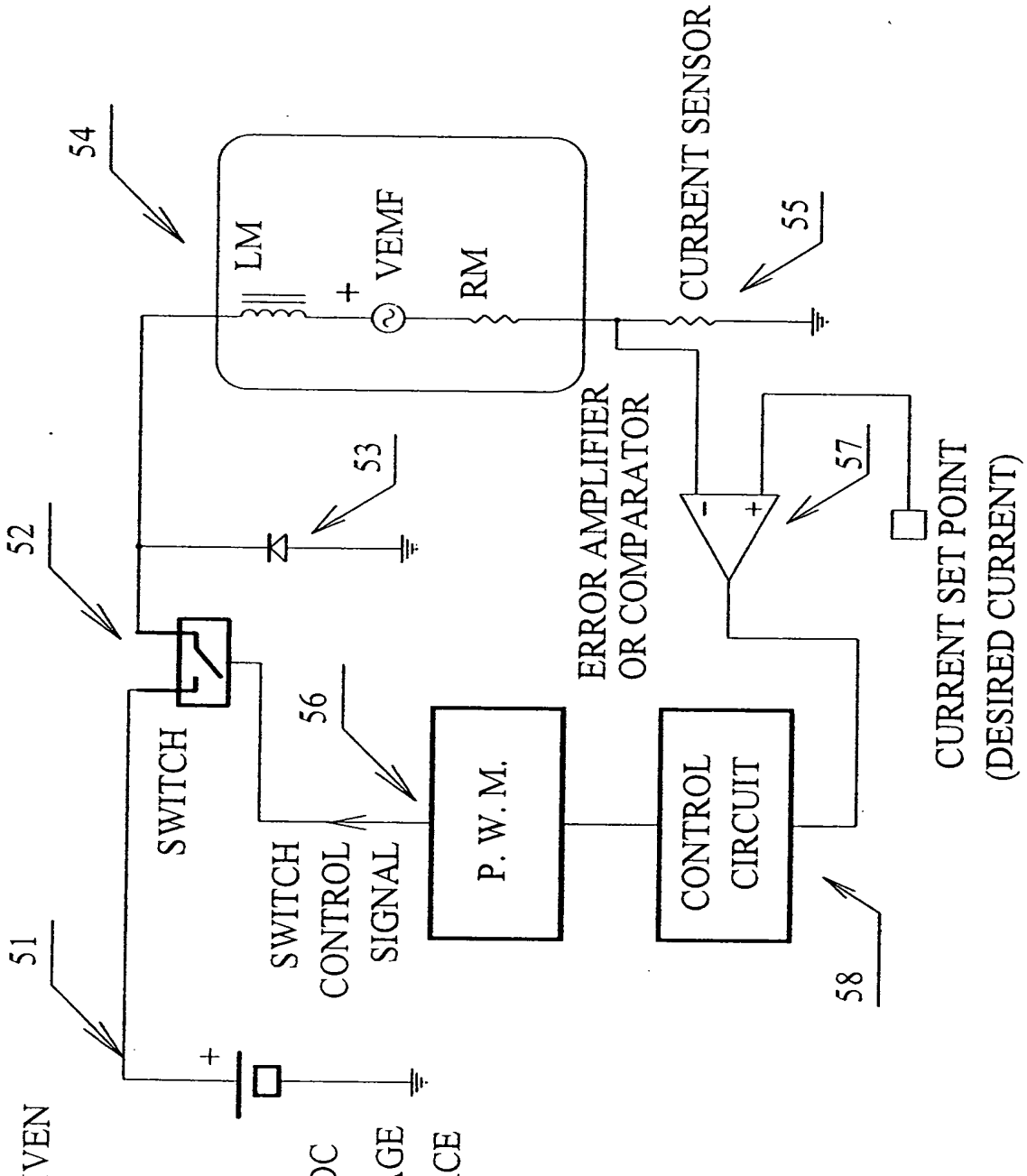

CURRENT DRIVEN
DC MOTOR
DC
VOLTAGE
SOURCE
SWITCH
SWITCH
CONTROL
SIGNAL
P. W. M.
CONTROL
CIRCUIT
ERROR AMPLIFIER
OR COMPARATOR
CURRENT SET POINT
(DESIRED CURRENT)
CURRENT SENSOR
LM
VEMF
RM
51
52
53
54
55
56
57
58

Fig. 6

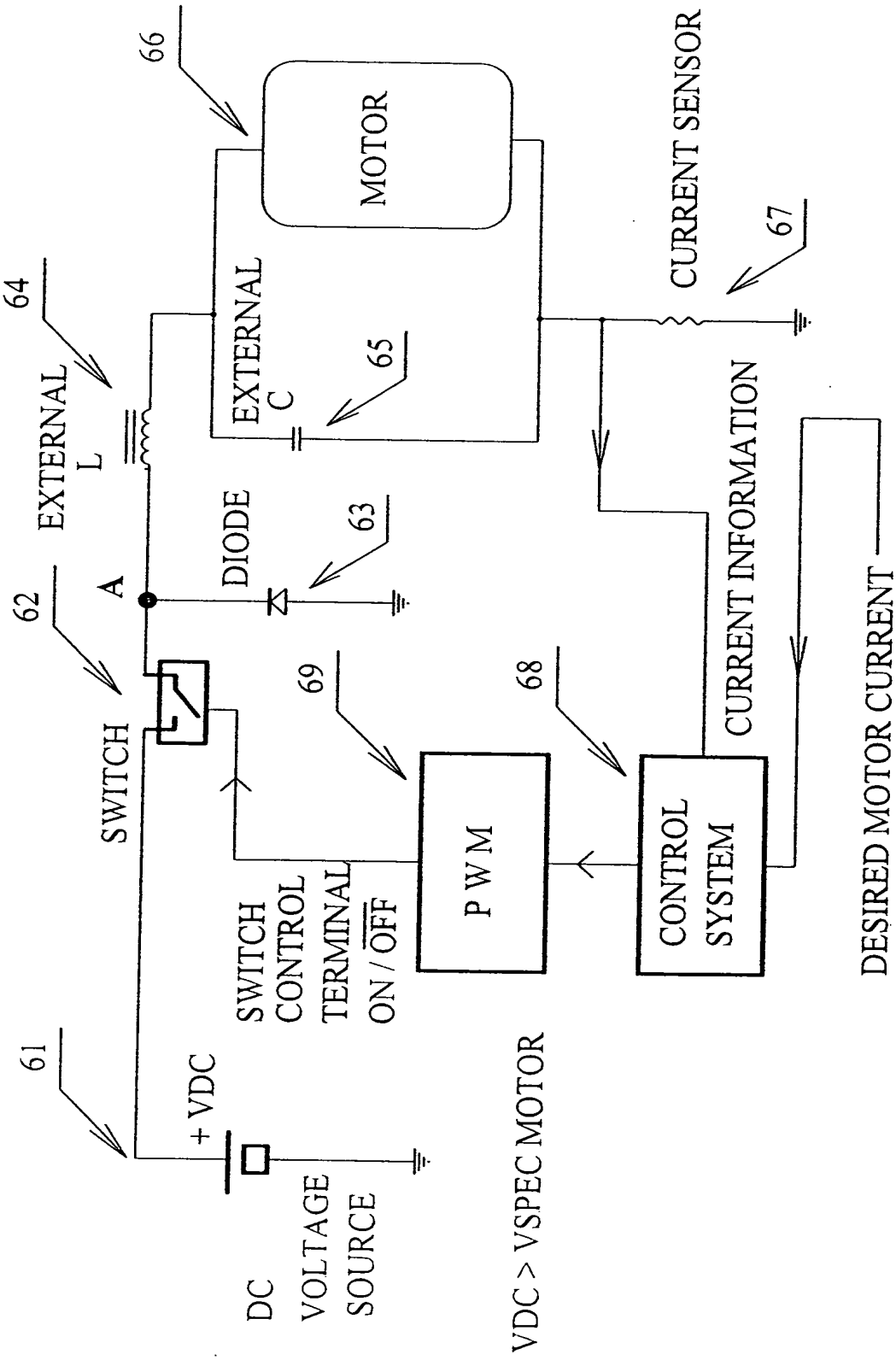
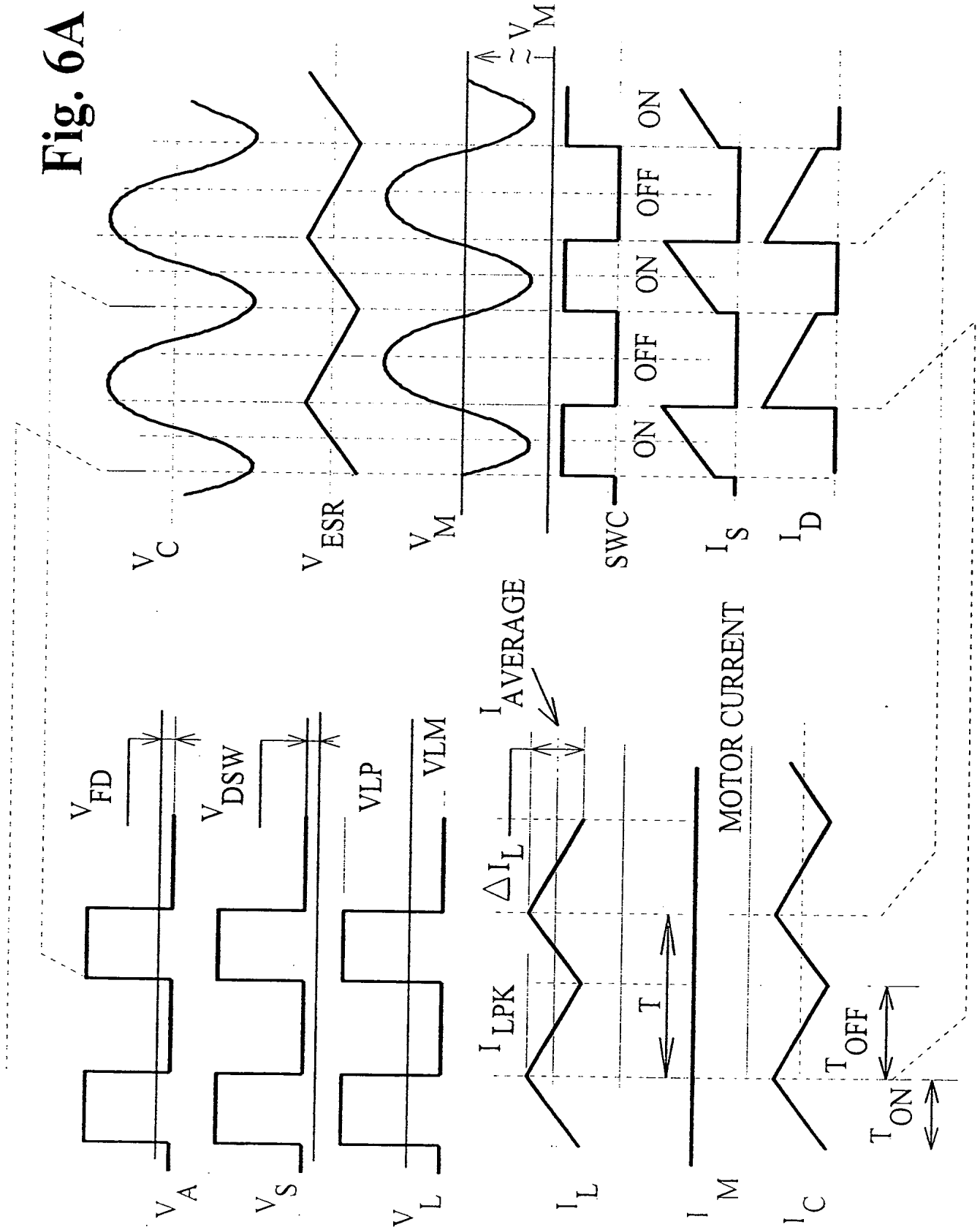

66
MOTOR
64
EXTERNAL
L
EXTERNAL
C
65
CURRENT SENSOR
67
62
A
DIODE
63
SWITCH
69
68
CURRENT INFORMATION
61
+ VDC
SWITCH
CONTROL
TERMINAL
ON / OFF
P W M
CONTROL
SYSTEM
DESIRED MOTOR CURRENT
DC
VOLTAGE
SOURCE
VDC > VSPEC MOTOR

Fig. 6A


V_C
V_ESR
V_M
≈ V_M
SWC
ON
OFF
ON
OFF
ON
I_S
I_D
V_FD
V_DSW
VLP
VLM
V_A
V_S
V_L
I_AVERAGE
ΔI_L
I_LPK
I_L
T
MOTOR CURRENT
I_M
I_C
T_OFF
T_ON

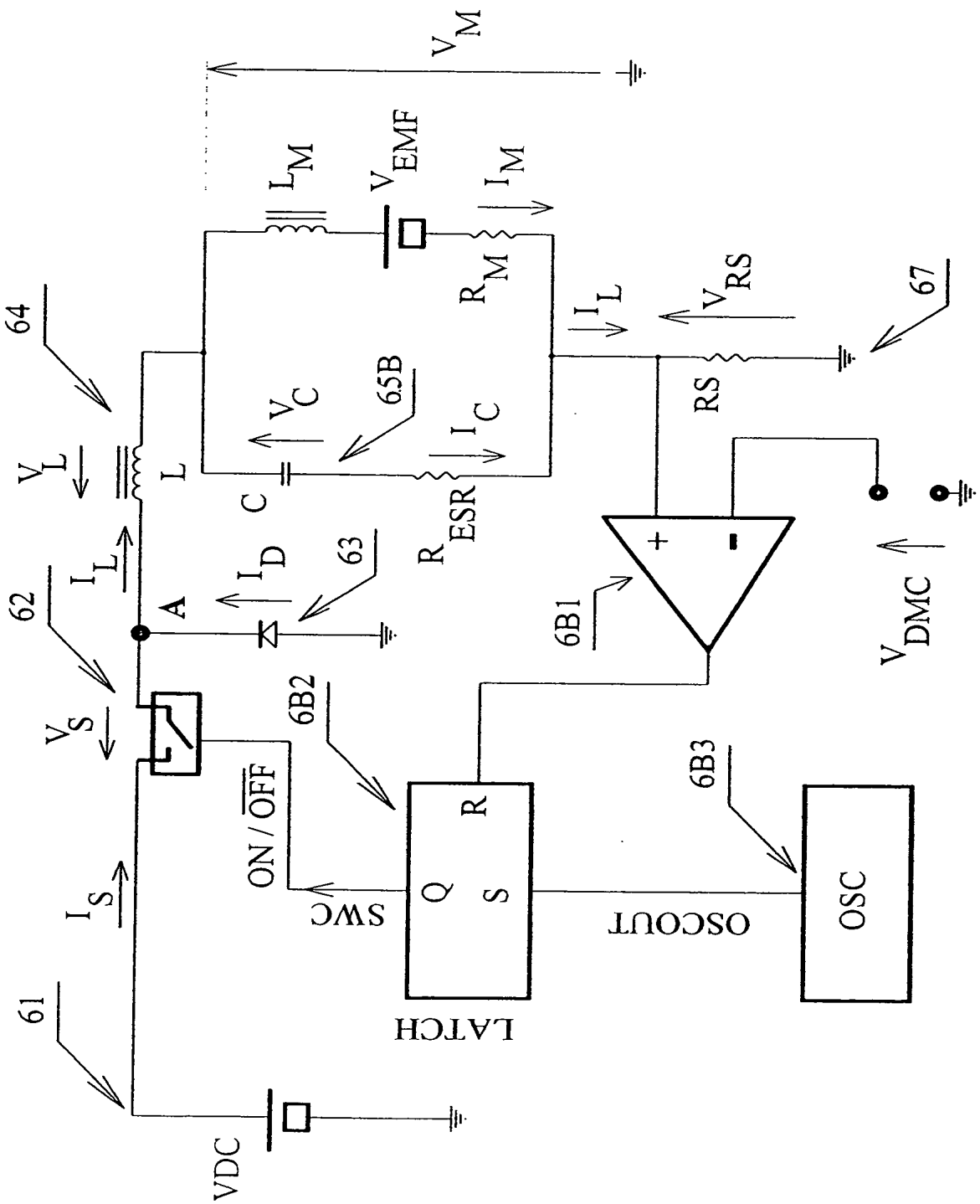
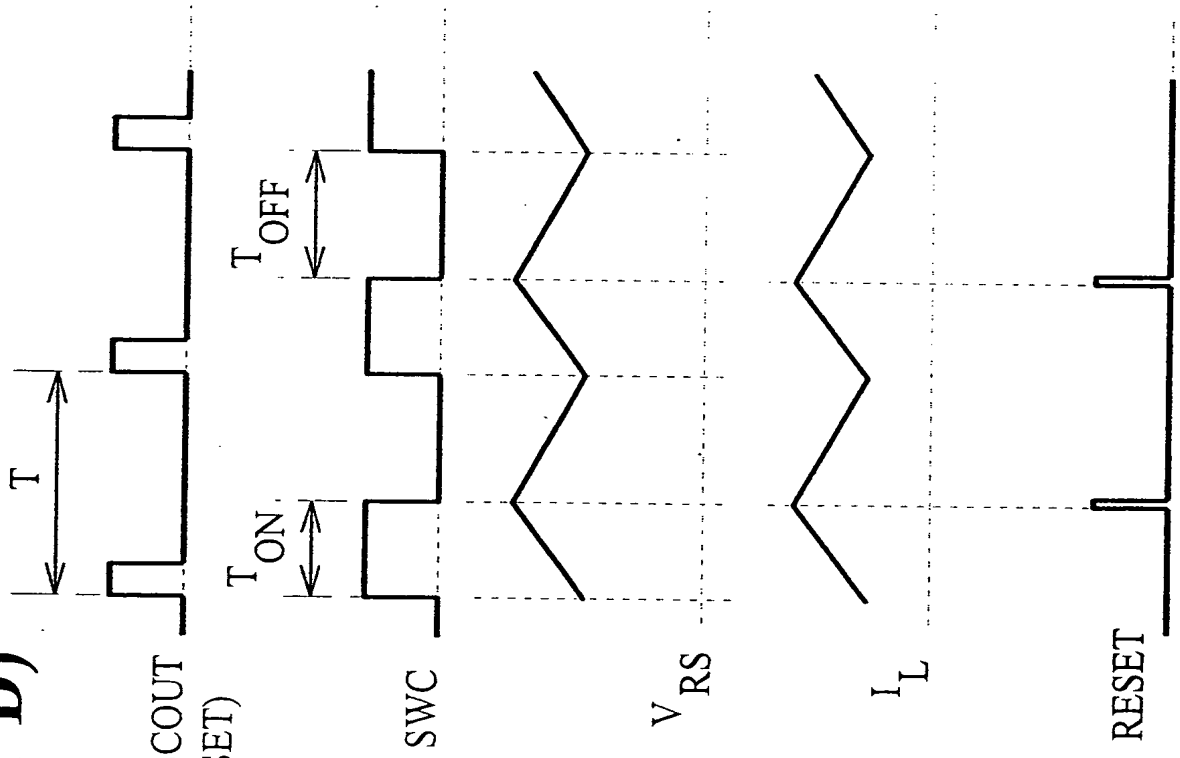

VM
LM
VEMF
IM
RM
IL
VRS
67
64
VC
65B
IC
RS
VL
L
C
RESR
ID
63
IL
62
A
6B1
VDMC
VS
6B2
ON / OFF
R
6B3
IS
SWC
Q
S
OSCOUT
OSC
LATCH
61
VDC

Fig. 6B

Fig. 6B (CONT'D)



1) $V_S = V_{DC} - V_A$

2) $V_L = V_A - V_M$

3) $V_M \cong I_M \cdot R_M + Vemf$

4) $Vemf = Kv \cdot \omega_M$

5) $I_S = I_L$

6) $I_L = I_C + I_M$

7) $I_L = V_{RS} / R_S$

8) $V_M = V_C + I_C \cdot R_{ESR}$

9) $T = T_{ON} + T_{OFF}$

10) $I_L = I_{AVERAGE} + I_L(t)$

11) $I_{LPK} = I_{AVERAGE} + (\Delta I_L / 2)$

12) $I_{LMIN} = I_{AVERAGE} - (\Delta I_L / 2)$

13) $I_M = I_{AVERAGE}$

14) $I_C = I_L(t)$

15) $$I_L(t) = \frac{1}{L} \int V_L(t)\, dt$$

16) $$I_L = \frac{V_L}{L} t = \frac{V_A - V_M}{L} t$$

17) $$I_L = \frac{V_{DC} - V_S - V_M}{L} t$$

FIG. 6C-1

18) $$\Delta I_L = \frac{V_{DC} - V_S - V_M}{L} T_{ON}$$

19) $$| \Delta I_L | = \frac{V_M + V_{FD}}{L} T_{OFF}$$

20) $$T_{ON} \frac{V_{DC} - V_S - V_M}{L} = \frac{V_M + V_{FD}}{L} T_{OFF}$$

21) $$T_{ON} (V_{DC} - V_M) \cong V_M \ T_{OFF}$$

22) $$V_M \cong V_{DC} \frac{T_{ON}}{T_{ON} + T_{OFF}} = V_{DC} \frac{T_{ON}}{T}$$

23) $$\Delta Q = \frac{1}{2} \frac{T}{2} \frac{\Delta I_L}{2}$$

24) $$\Delta V_{CC} = \frac{\Delta Q}{C} = \frac{\Delta I_L}{f \ 8 \ C}$$

25) $$\Delta V_C = \Delta V_{CC} + \Delta I_L \ R_{ESR}$$

26) $$\Delta V_C << V_M$$

FIG. 6C-2

Fig. 6C-2 (CONT'D)

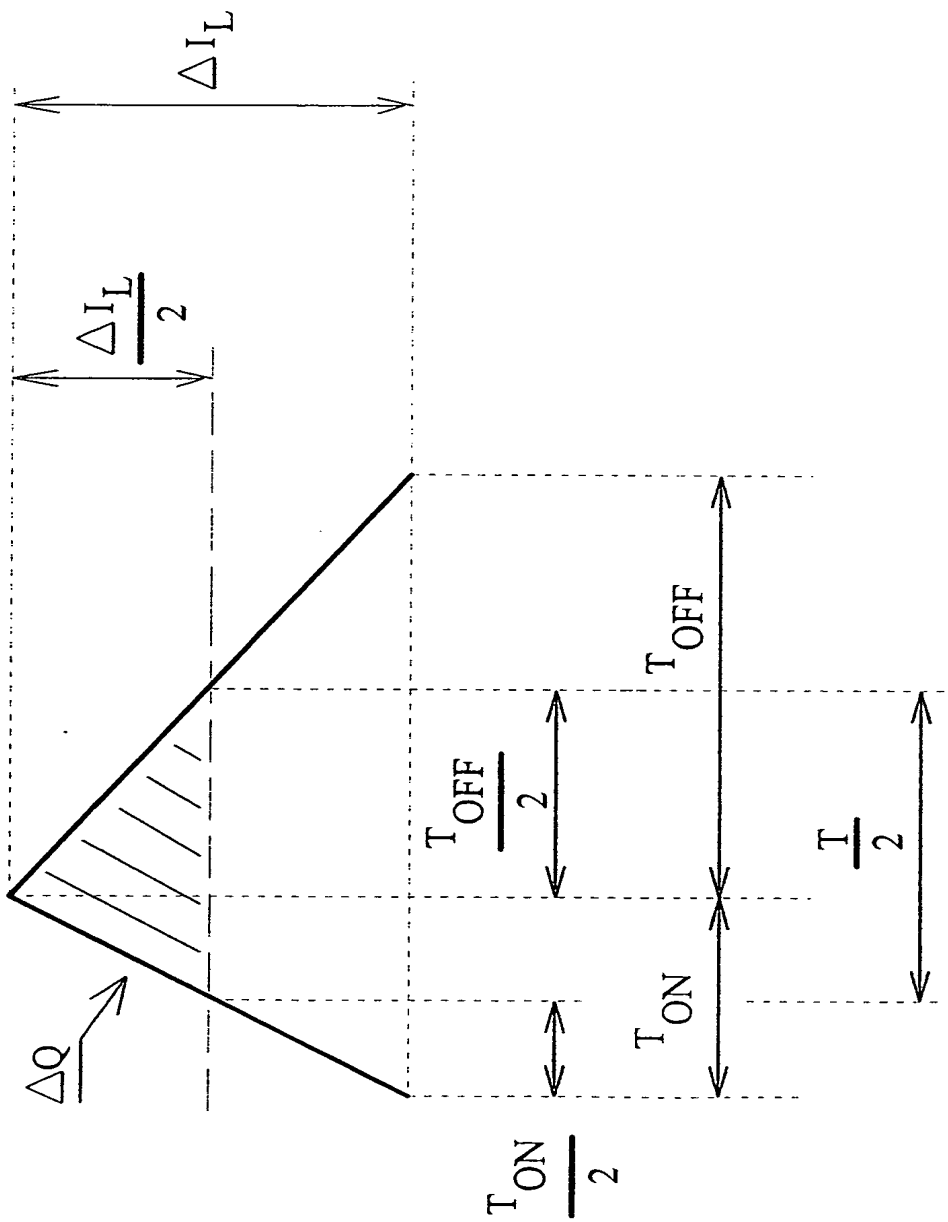
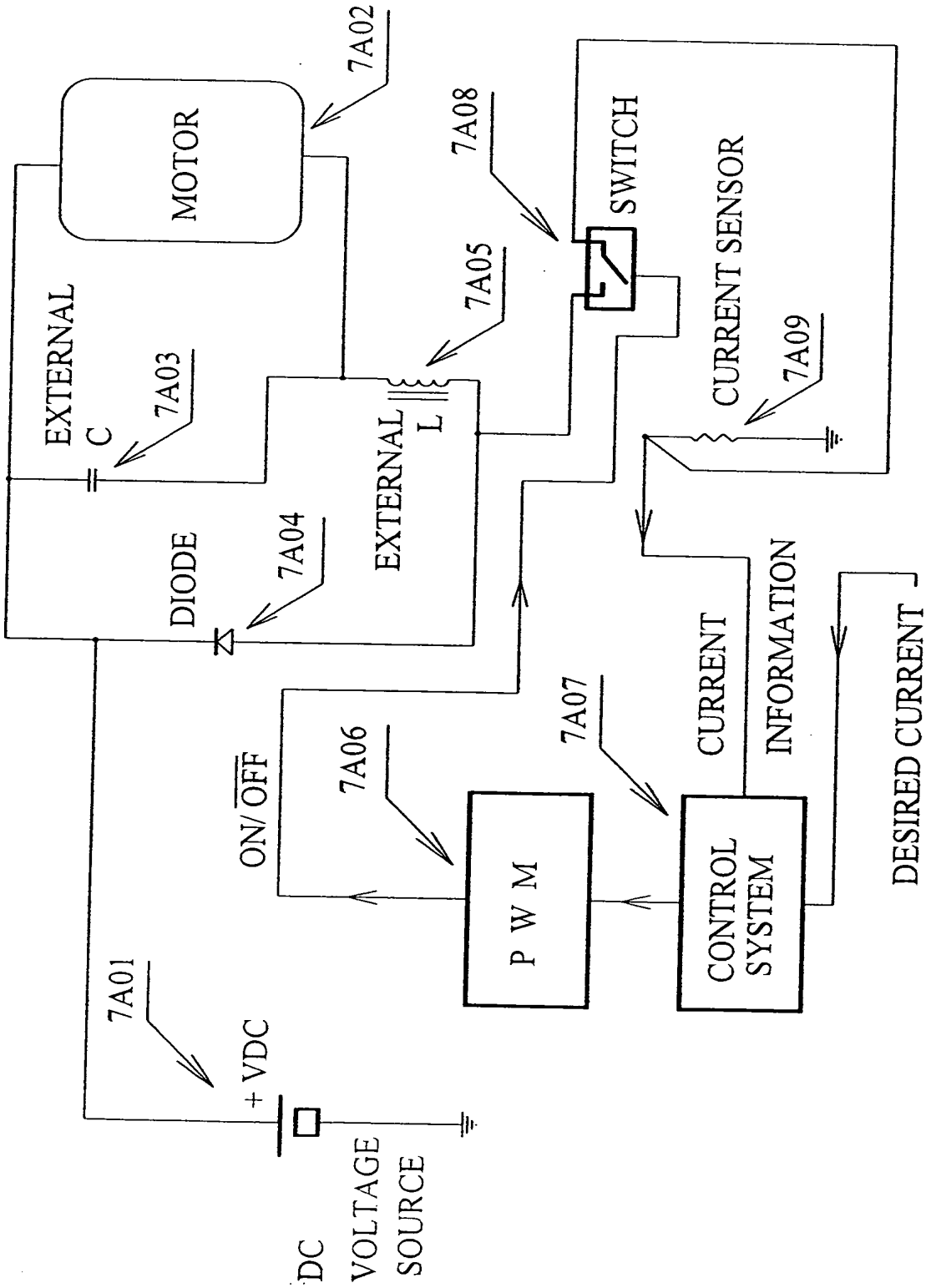


Fig. 7A


7A02
MOTOR
7A08
SWITCH
CURRENT SENSOR
7A09
7A05
EXTERNAL
C
7A03
EXTERNAL
L
DIODE
7A04
ON/ OFF
7A06
7A07
CURRENT
INFORMATION
DESIRED CURRENT
P W M
CONTROL
SYSTEM
7A01
+ VDC
DC
VOLTAGE
SOURCE

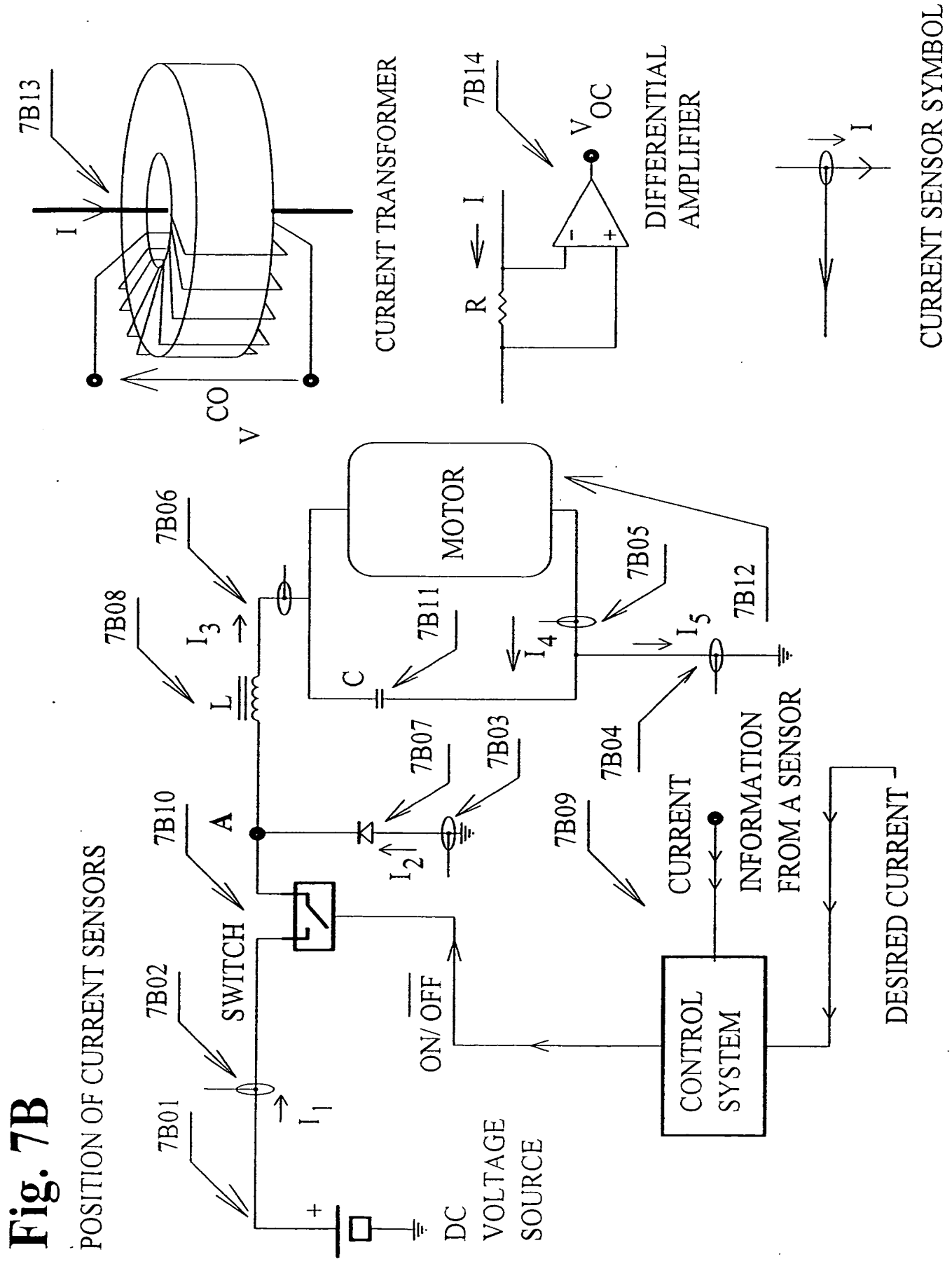
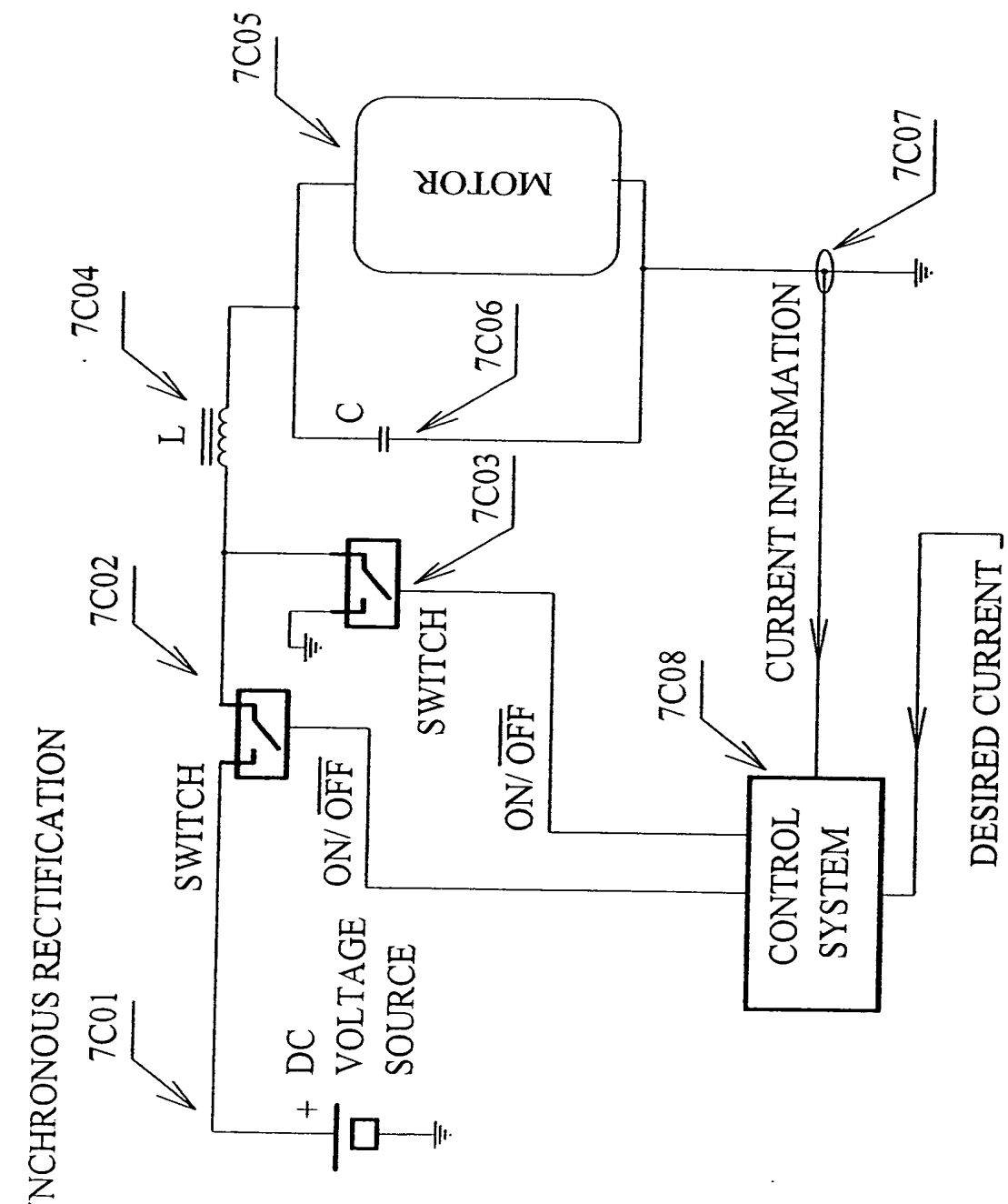


Fig. 7B

POSITION OF CURRENT SENSORS

Fig. 7C

WITH SYNCHRONOUS RECTIFICATION



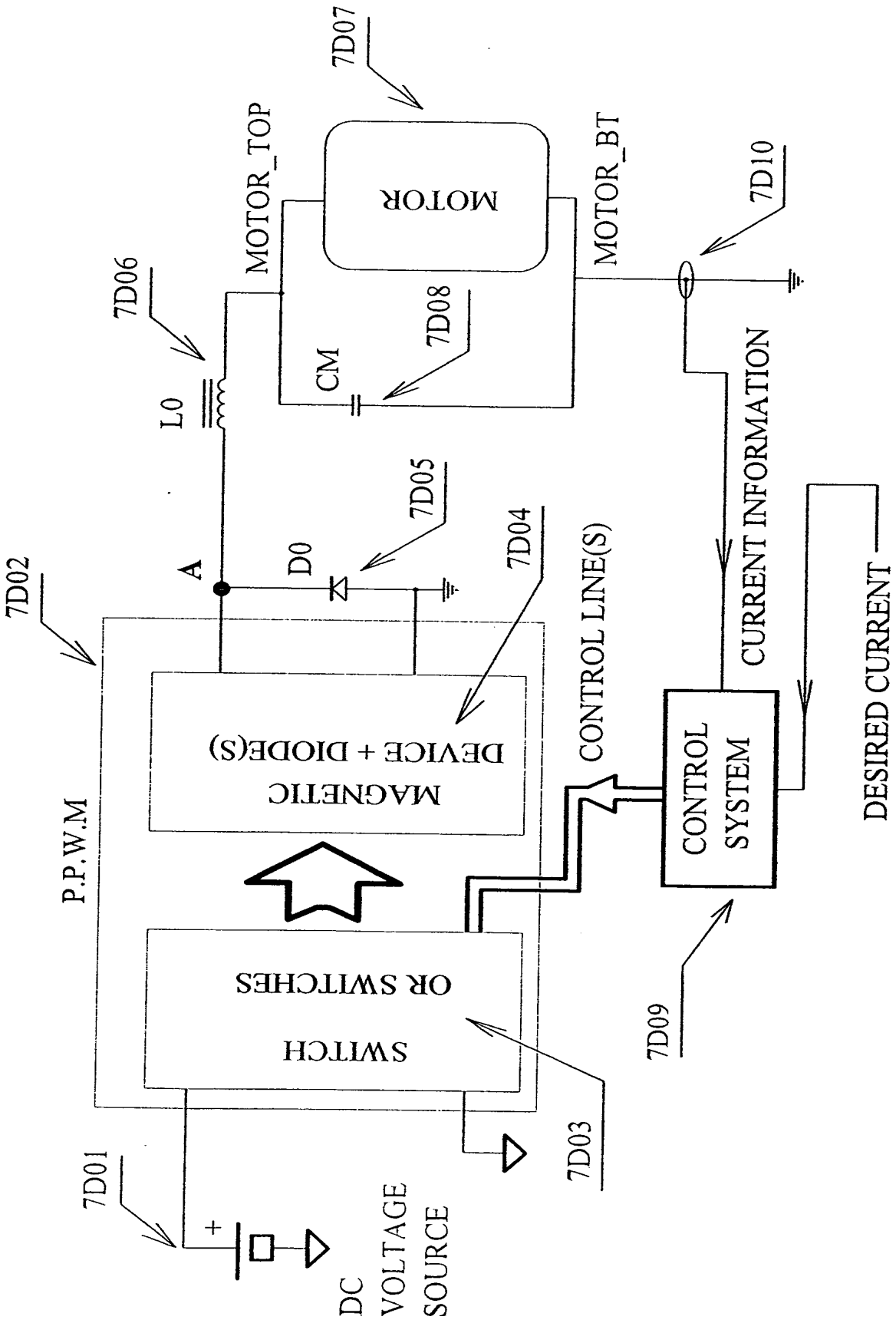

7D07
MOTOR
MOTOR_TOP
MOTOR_BT
7D10
7D06
L0
CM
7D08
A
D0
7D05
7D04
7D02
CONTROL LINE(S)
CURRENT INFORMATION
DESIRED CURRENT
MAGNETIC DEVICE + DIODE(S)
CONTROL SYSTEM
P.P.W.M
SWITCH OR SWITCHES
7D09
7D03
7D01
+
DC VOLTAGE SOURCE

Fig. 7D

Fig. 7E

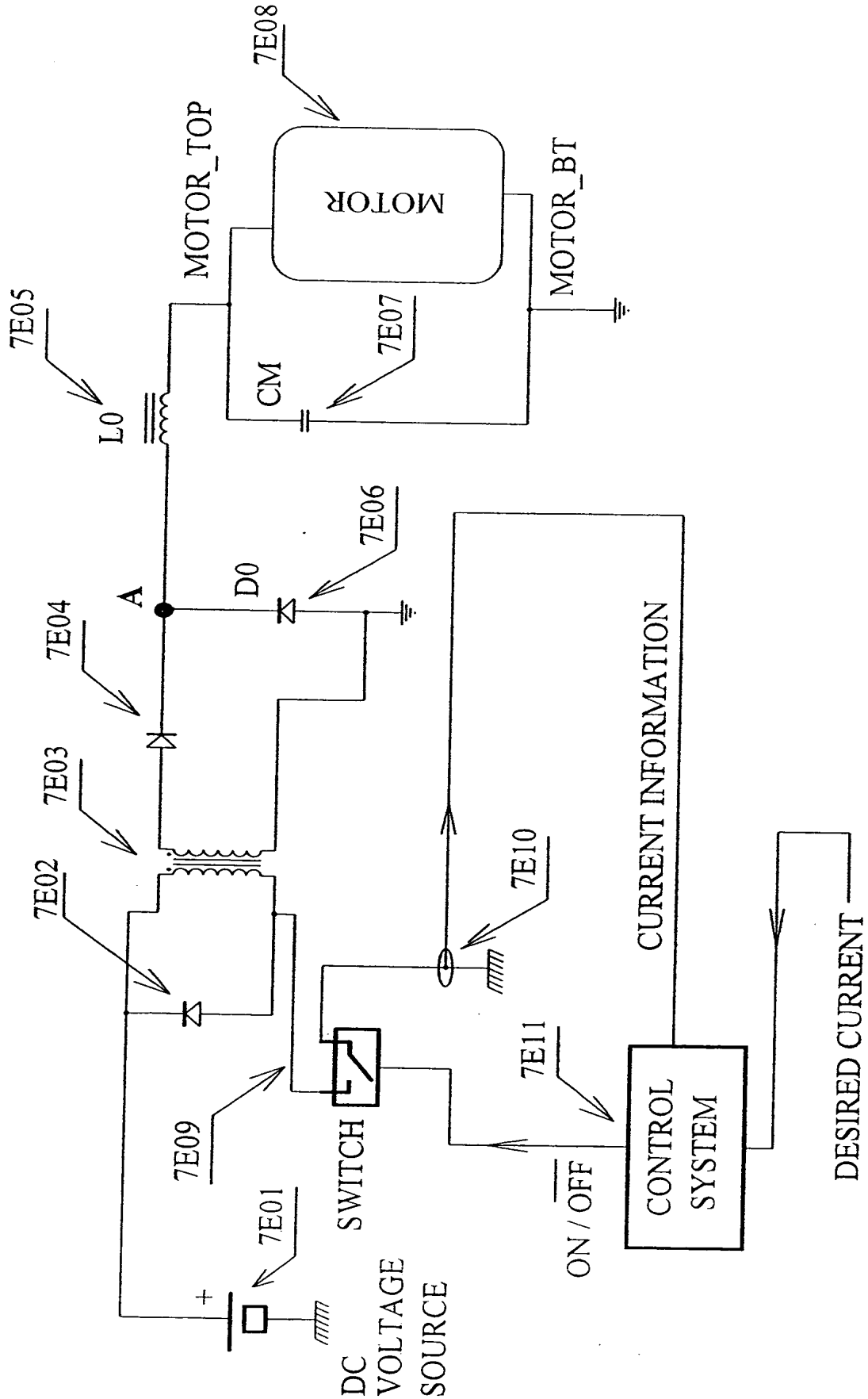

7E08
MOTOR_TOP
MOTOR
MOTOR_BT
7E05
L0
CM
7E07
7E06
D0
A
7E04
7E03
7E02
7E10
CURRENT INFORMATION
7E09
SWITCH
7E11
ON / OFF
CONTROL SYSTEM
DESIRED CURRENT
7E01
+
DC VOLTAGE SOURCE

Fig. 7F

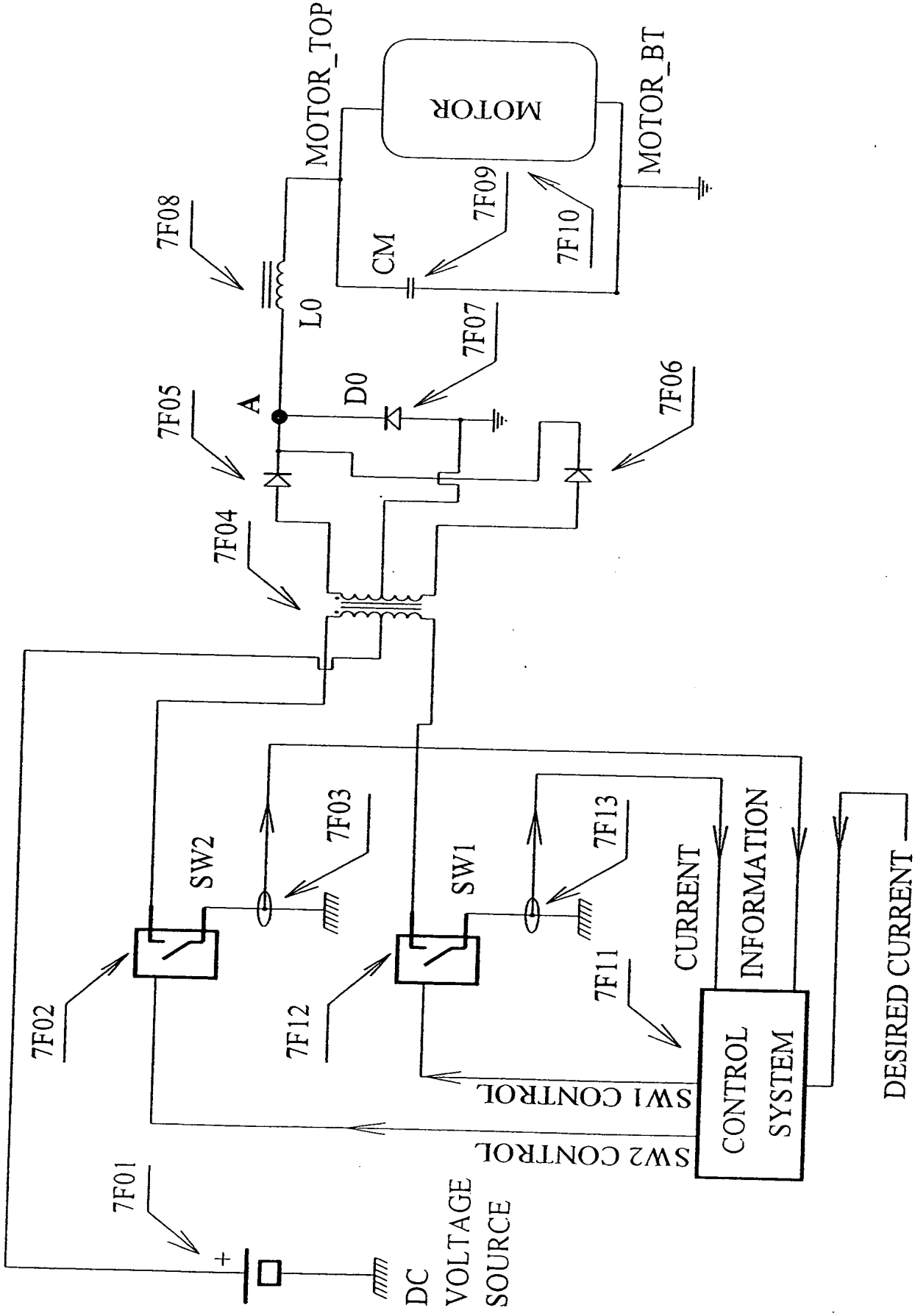

MOTOR
MOTOR_TOP
MOTOR_BT
7F08
L0
CM
7F09
7F10
7F07
D0
A
7F05
7F06
7F04
SW2
7F03
SW1
7F13
7F02
7F12
7F11
CURRENT INFORMATION
SW1 CONTROL
SW2 CONTROL
CONTROL SYSTEM
DESIRED CURRENT
7F01
+
DC VOLTAGE SOURCE

Fig. 7G

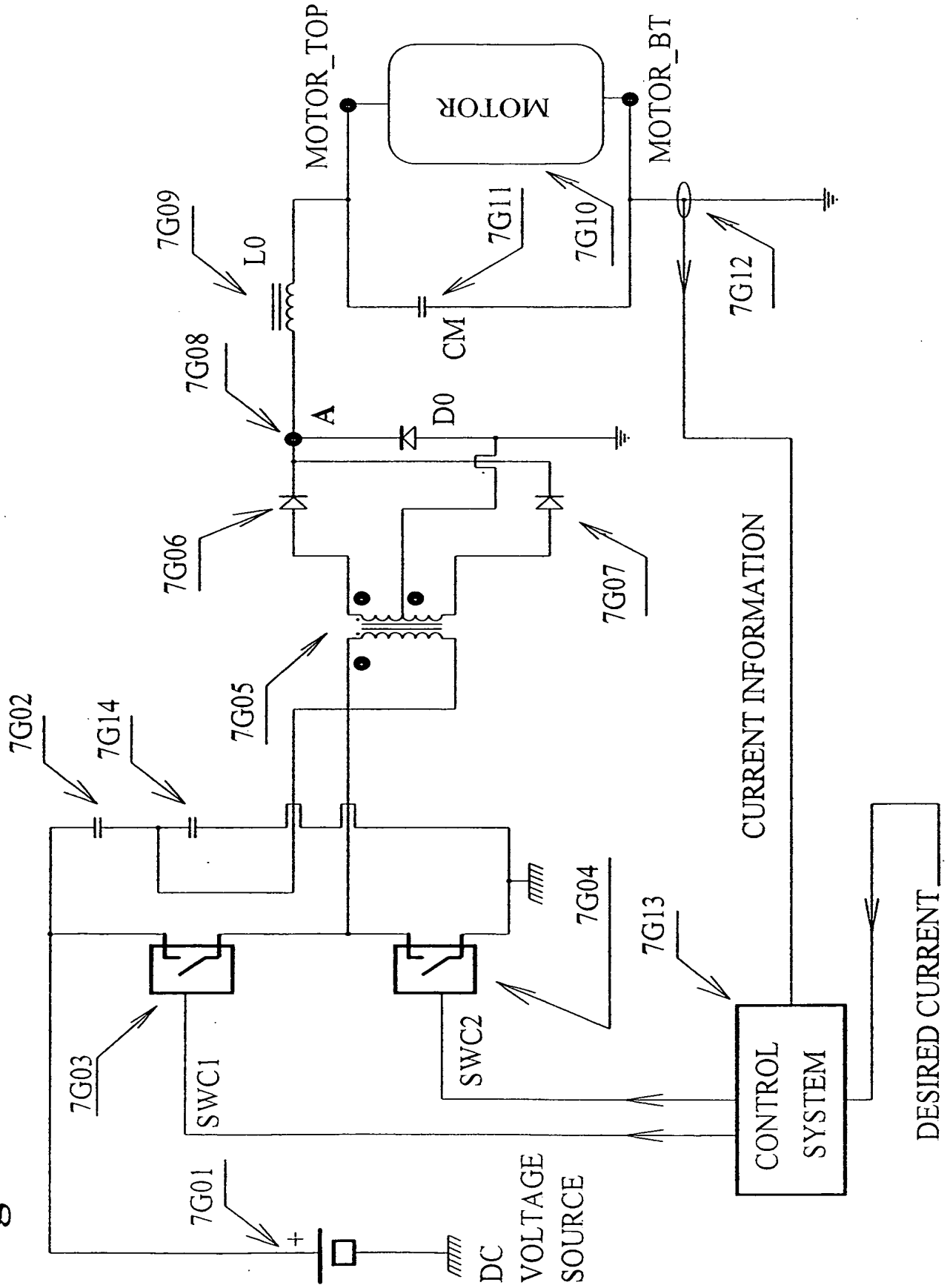
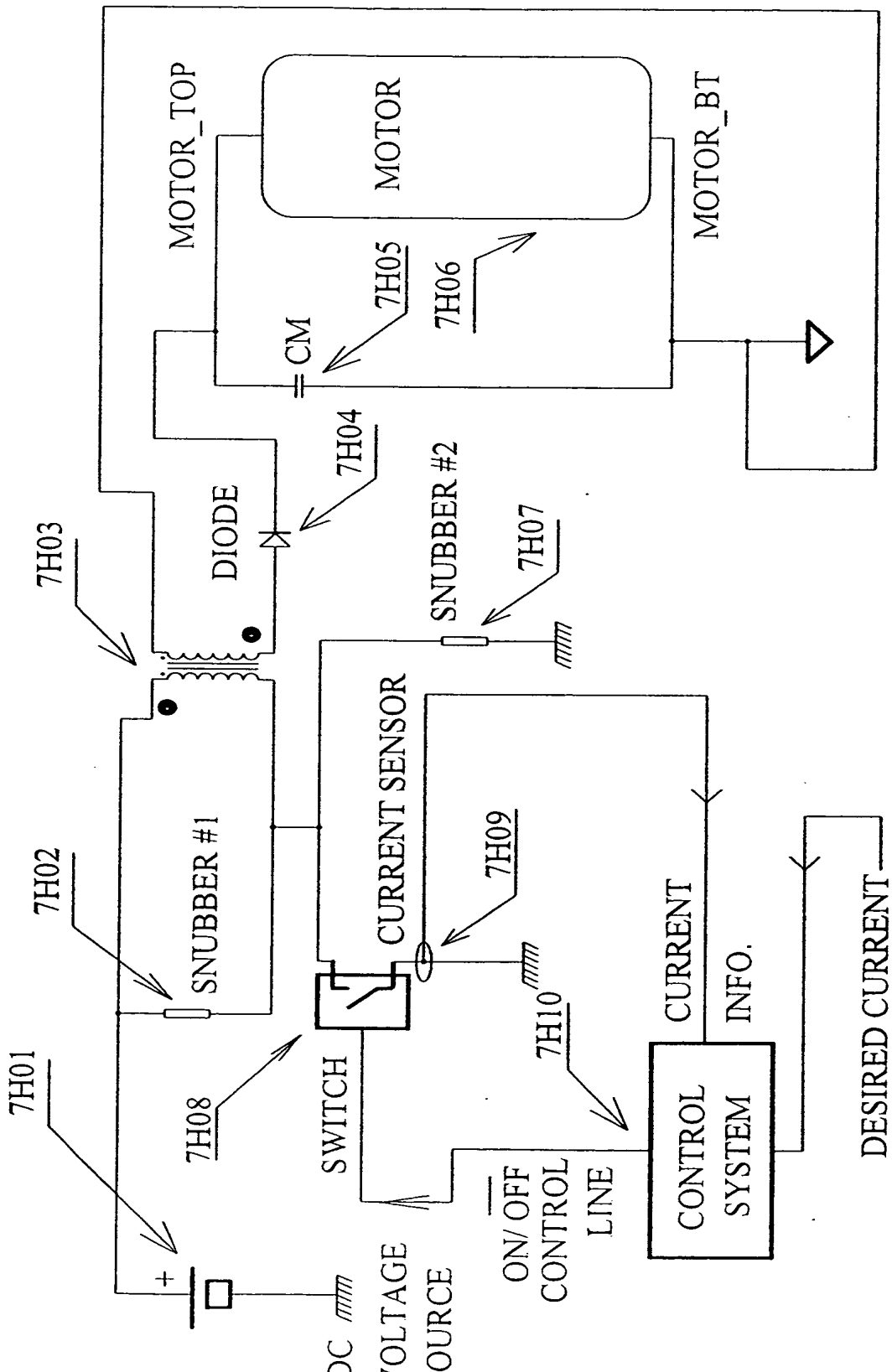

MOTOR
MOTOR_TOP
MOTOR_BT
7G09
L0
7G11
7G10
7G12
CM
7G08
A
D0
7G06
7G07
7G05
7G02
7G14
7G04
7G13
CURRENT INFORMATION
7G03
SWC1
SWC2
CONTROL SYSTEM
DESIRED CURRENT
7G01
+
DC VOLTAGE SOURCE

Fig. 7H


MOTOR_TOP
MOTOR
MOTOR_BT
CM
7H05
7H06
7H04
DIODE
7H03
SNUBBER #2
7H07
7H02
SNUBBER #1
CURRENT SENSOR
7H09
7H01
7H08
SWITCH
7H10
CURRENT
INFO.
CONTROL
SYSTEM
DESIRED CURRENT
ON/ OFF
CONTROL
LINE
DC
VOLTAGE
SOURCE
+

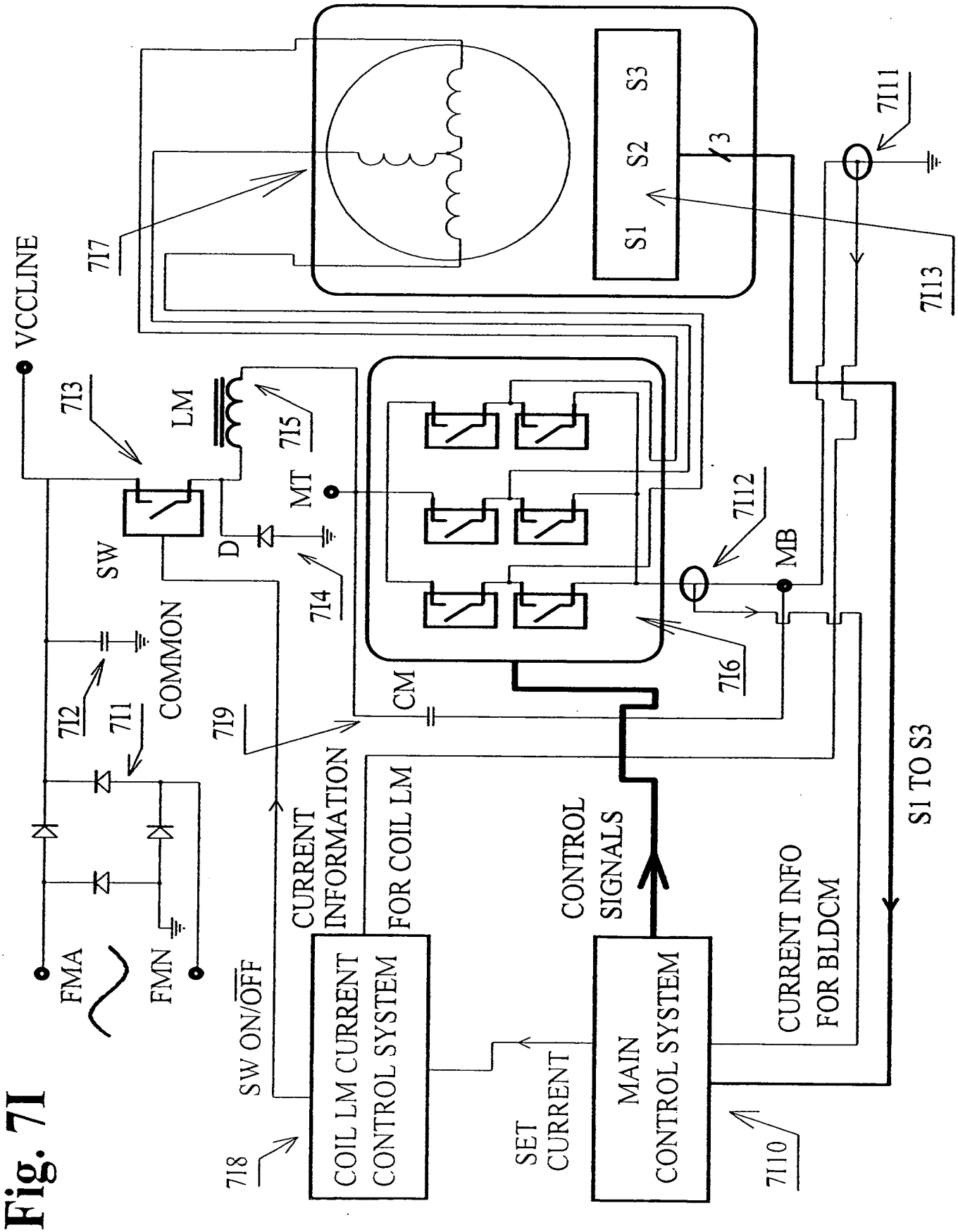

VCCLINE
FMA
FMN
SW ON/OFF
718
COIL LM CURRENT CONTROL SYSTEM
CURRENT INFORMATION FOR COIL LM
SET CURRENT
MAIN CONTROL SYSTEM
7110
CONTROL SIGNALS
CURRENT INFO FOR BLDCM
S1 TO S3
719
711
712
COMMON
713
SW
LM
715
D
MT
714
CM
716
7112
MB
7111
7113
717
S1
S2
S3
3

Fig. 7I

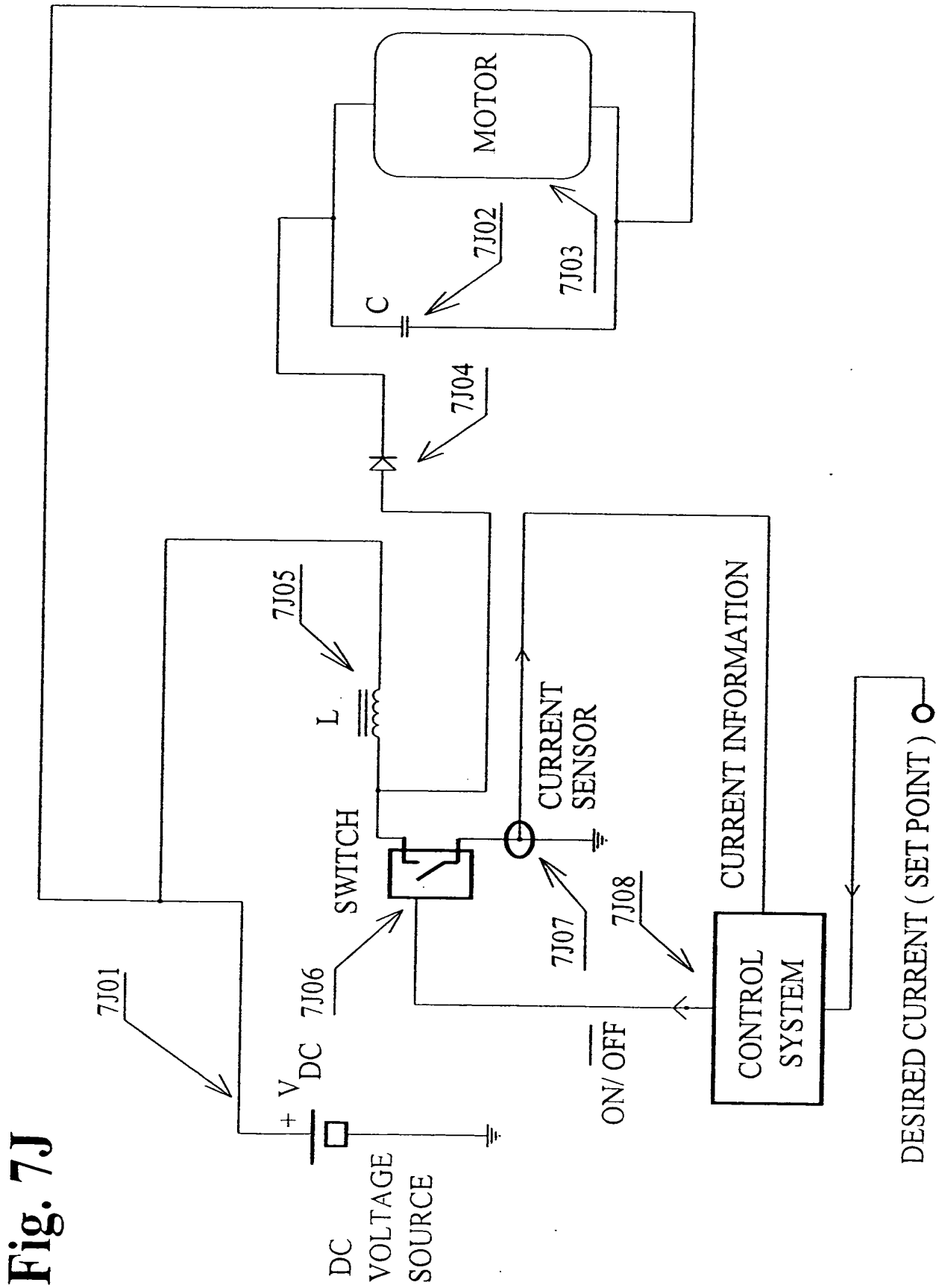

MOTOR
7J02
7J03
C
7J04
7J05
L
SWITCH
CURRENT SENSOR
CURRENT INFORMATION
7J01
7J06
7J07
7J08
+ V_{DC}
ON/ OFF
CONTROL SYSTEM
DESIRED CURRENT (SET POINT)
DC VOLTAGE SOURCE

Fig. 7J

Fig. 7K

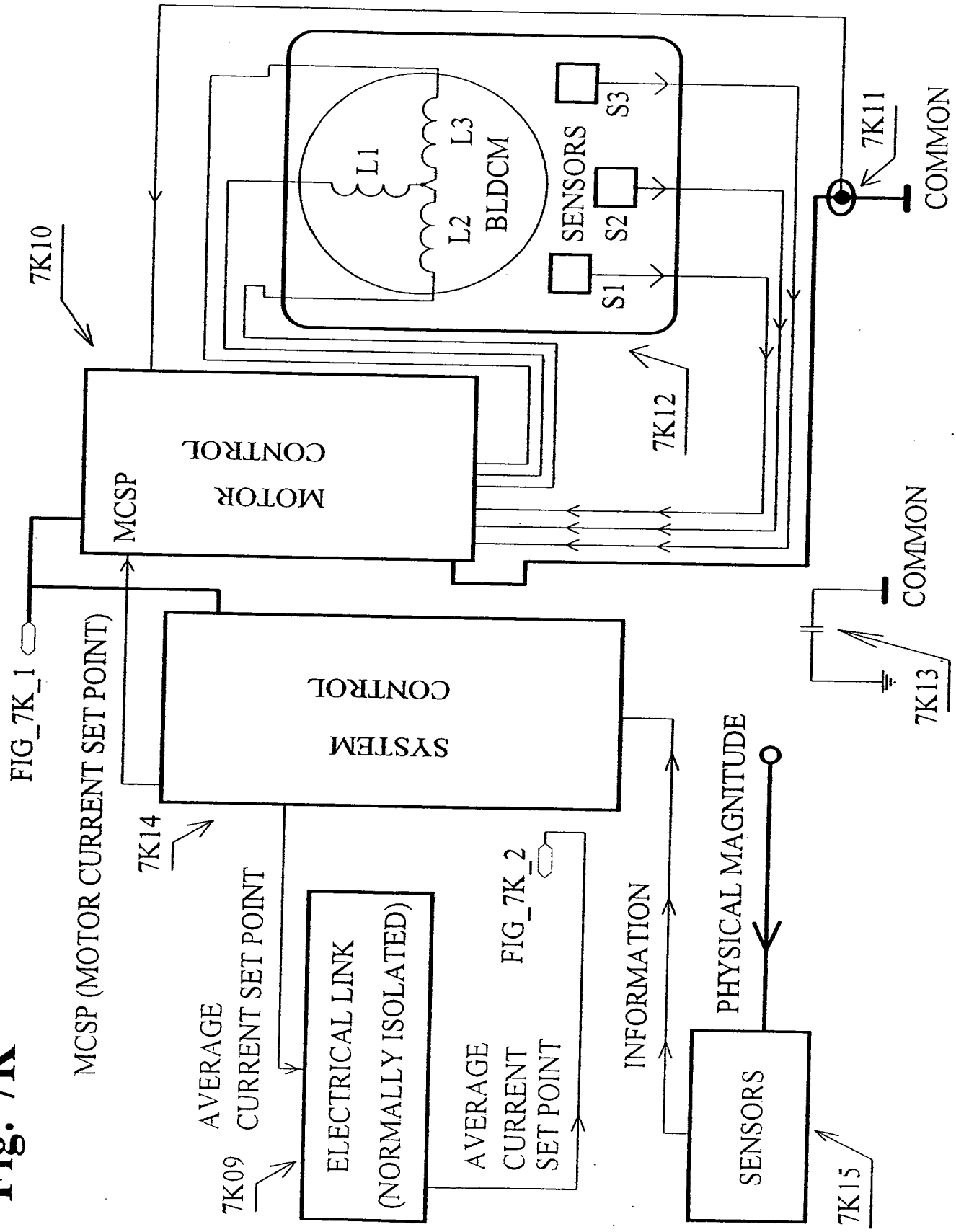

7K10
L1
L3
L2
BLDCM
SENSORS
S3
S2
S1
7K11
COMMON
7K12
MOTOR CONTROL
MCSP
COMMON
7K13
FIG_7K_1
MCSP (MOTOR CURRENT SET POINT)
SYSTEM CONTROL
7K14
AVERAGE CURRENT SET POINT
FIG_7K_2
INFORMATION
PHYSICAL MAGNITUDE
7K09
ELECTRICAL LINK (NORMALLY ISOLATED)
AVERAGE CURRENT SET POINT
SENSORS
7K15

Fig. 7K (CONT'D)

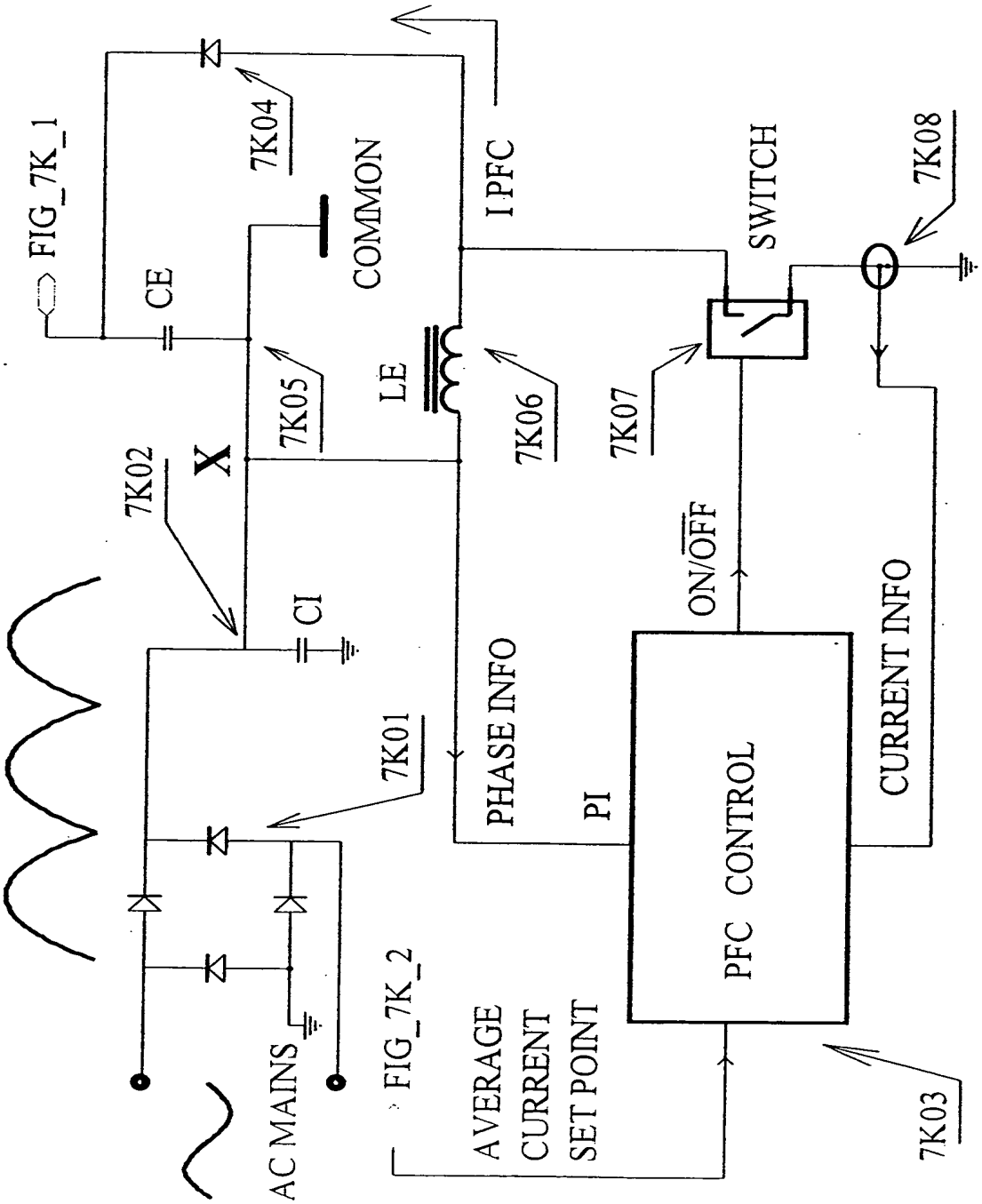


FIG_7K_1
CE
7K04
COMMON
I PFC
SWITCH
7K08
7K05
LE
7K06
7K07
7K02
X
CI
ON/OFF
PHASE INFO
7K01
PI
PFC CONTROL
CURRENT INFO
AC MAINS
FIG_7K_2
AVERAGE CURRENT SET POINT
7K03

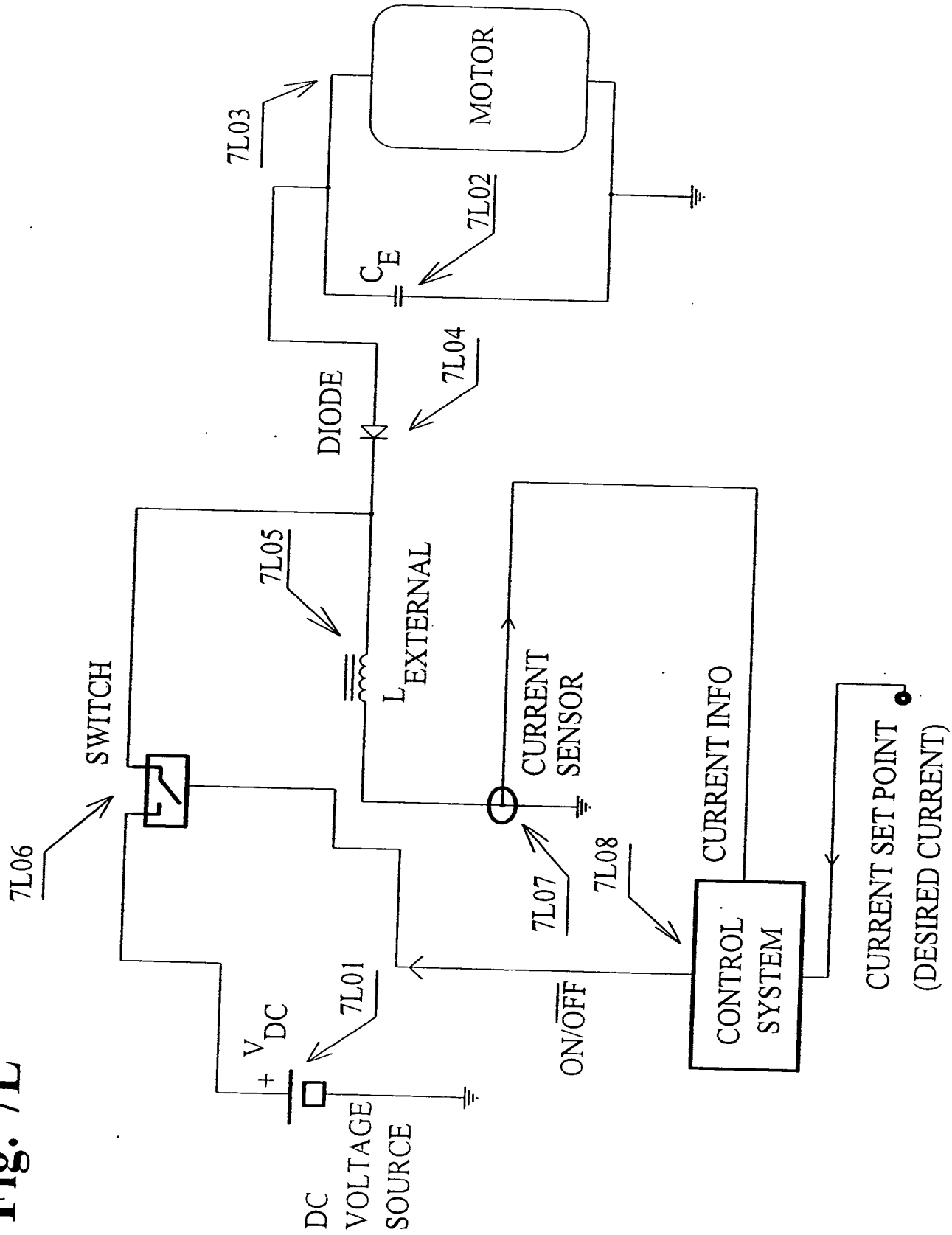

MOTOR
7L03
7L02
C_E
7L04
DIODE
7L05
$L_{EXTERNAL}$
SWITCH
7L06
CURRENT SENSOR
CURRENT INFO
7L07
7L08
CONTROL SYSTEM
CURRENT SET POINT
(DESIRED CURRENT)
ON/$\overline{OFF}$
V_{DC}
7L01
DC VOLTAGE SOURCE

Fig. 7L

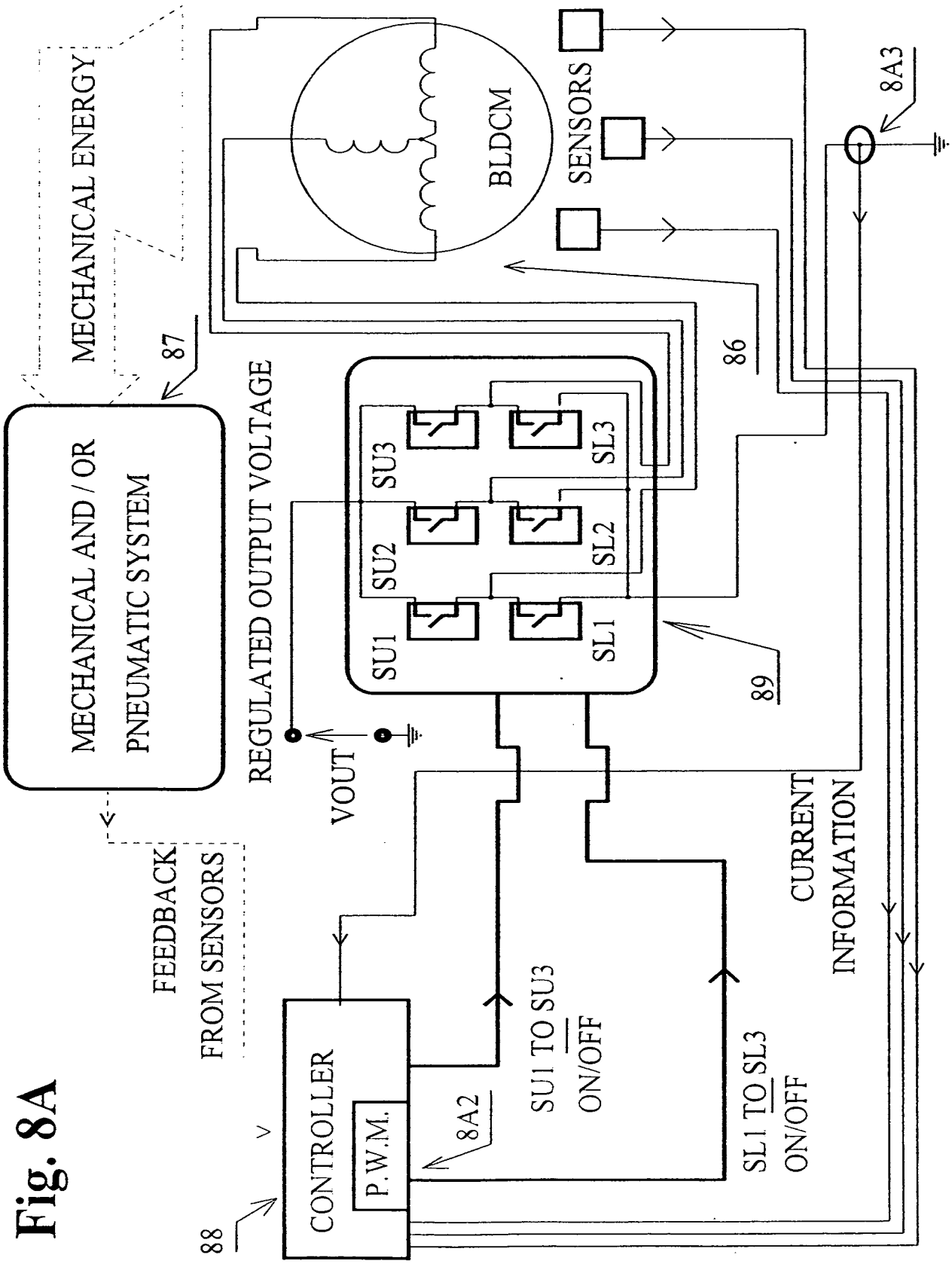
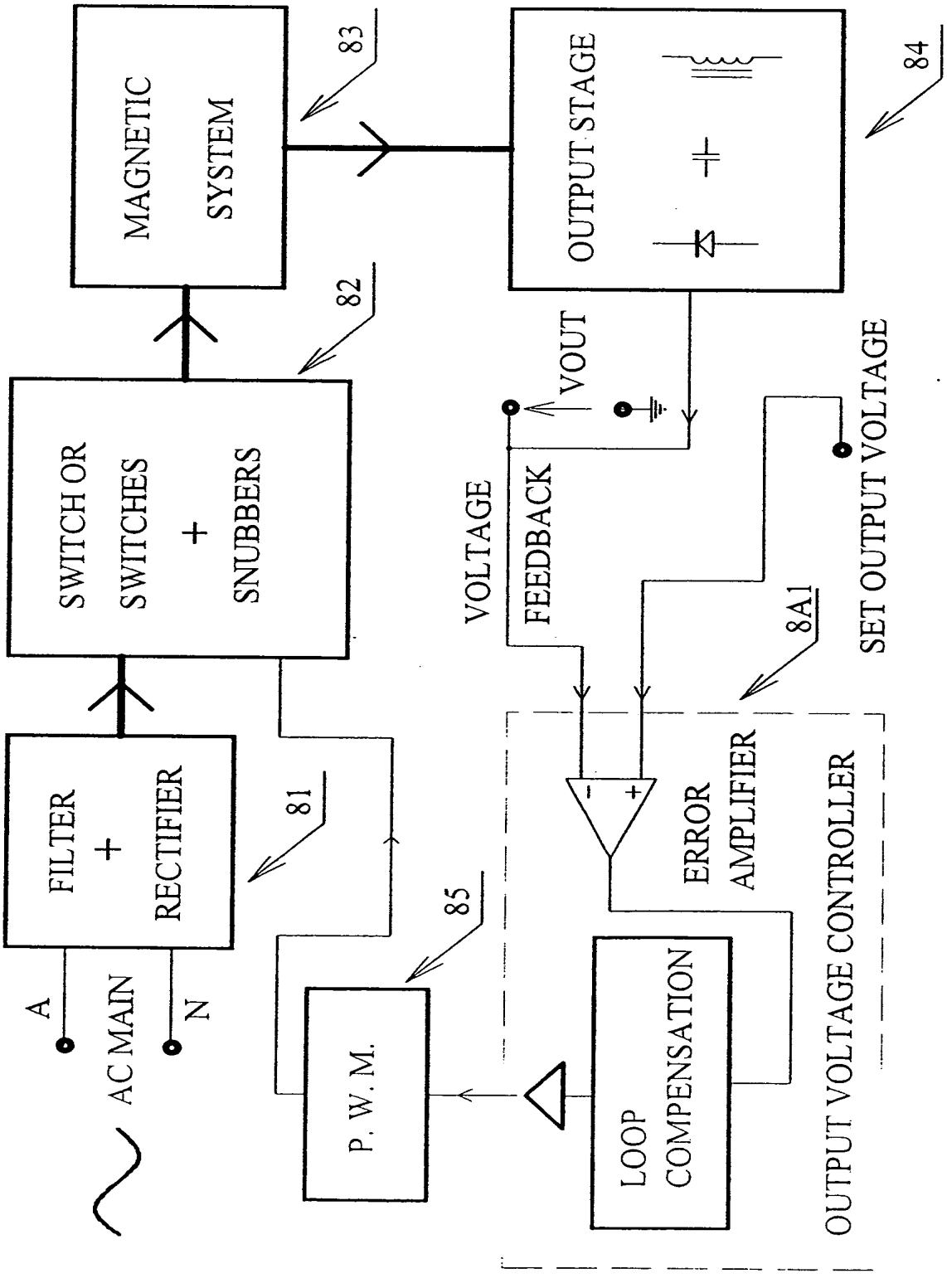

MECHANICAL ENERGY
87
MECHANICAL AND / OR
PNEUMATIC SYSTEM
FEEDBACK
FROM SENSORS
REGULATED OUTPUT VOLTAGE
VOUT
BLDCM
SENSORS
8A3
86
SU1
SU2
SU3
SL1
SL2
SL3
89
CONTROLLER
P.W.M.
8A2
88
V
SU1 TO SU3
ON/OFF
SL1 TO SL3
ON/OFF
CURRENT
INFORMATION

Fig. 8A

Fig. 8A (CONT'D)


MAGNETIC SYSTEM
83
OUTPUT STAGE
84
82
SWITCH OR SWITCHES + SNUBBERS
VOUT
VOLTAGE FEEDBACK
8A1
SET OUTPUT VOLTAGE
FILTER + RECTIFIER
81
ERROR AMPLIFIER
A
AC MAIN
N
85
P. W. M.
LOOP COMPENSATION
OUTPUT VOLTAGE CONTROLLER

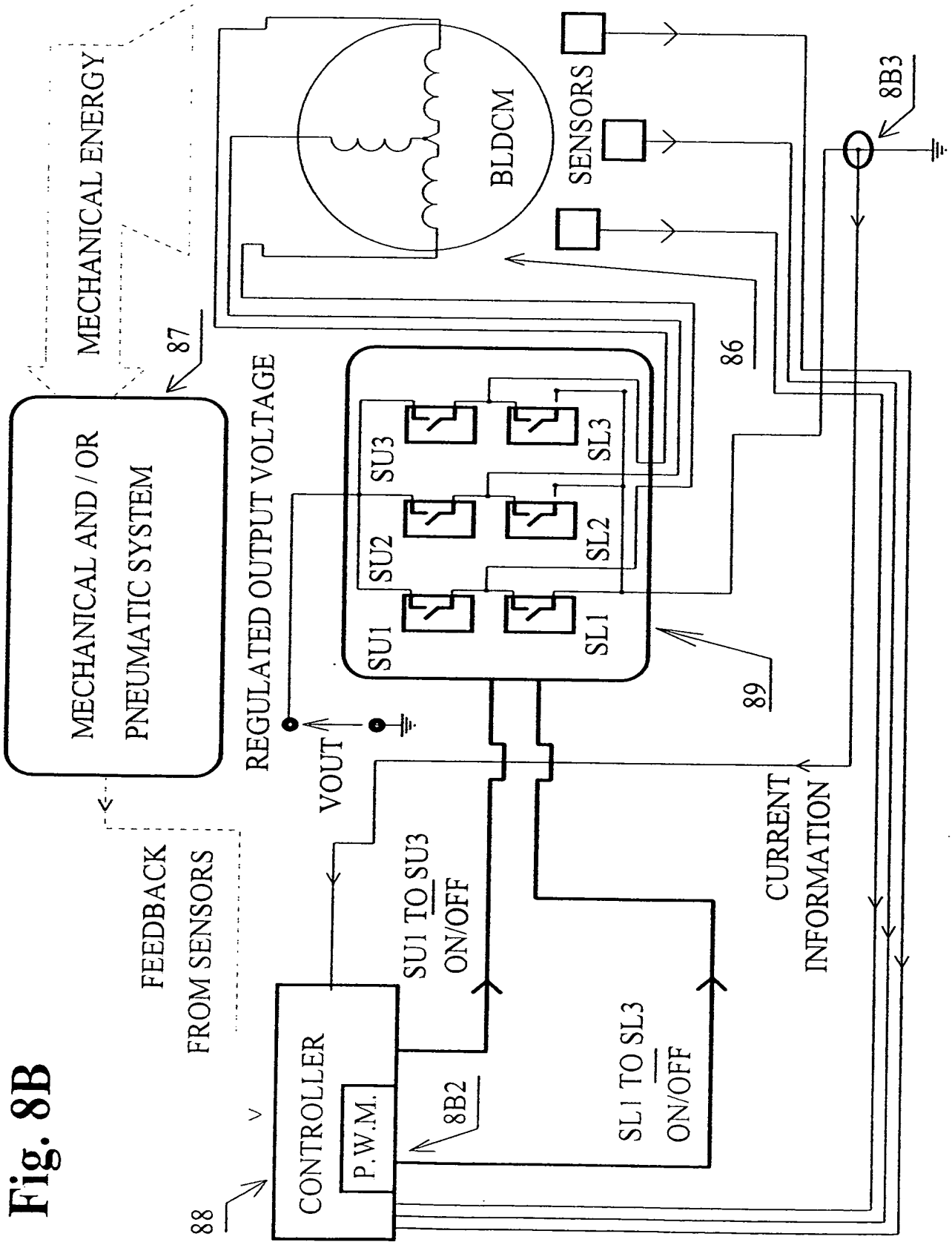

MECHANICAL ENERGY
87
MECHANICAL AND / OR
PNEUMATIC SYSTEM
FEEDBACK
FROM SENSORS
REGULATED OUTPUT VOLTAGE
VOUT
BLDCM
SENSORS
8B3
86
SU1
SU2
SU3
SL1
SL2
SL3
89
SU1 TO SU3
ON/OFF
SL1 TO SL3
ON/OFF
CURRENT
INFORMATION
CONTROLLER
P.W.M.
8B2
88

Fig. 8B

Fig. 8B (CONT'D)

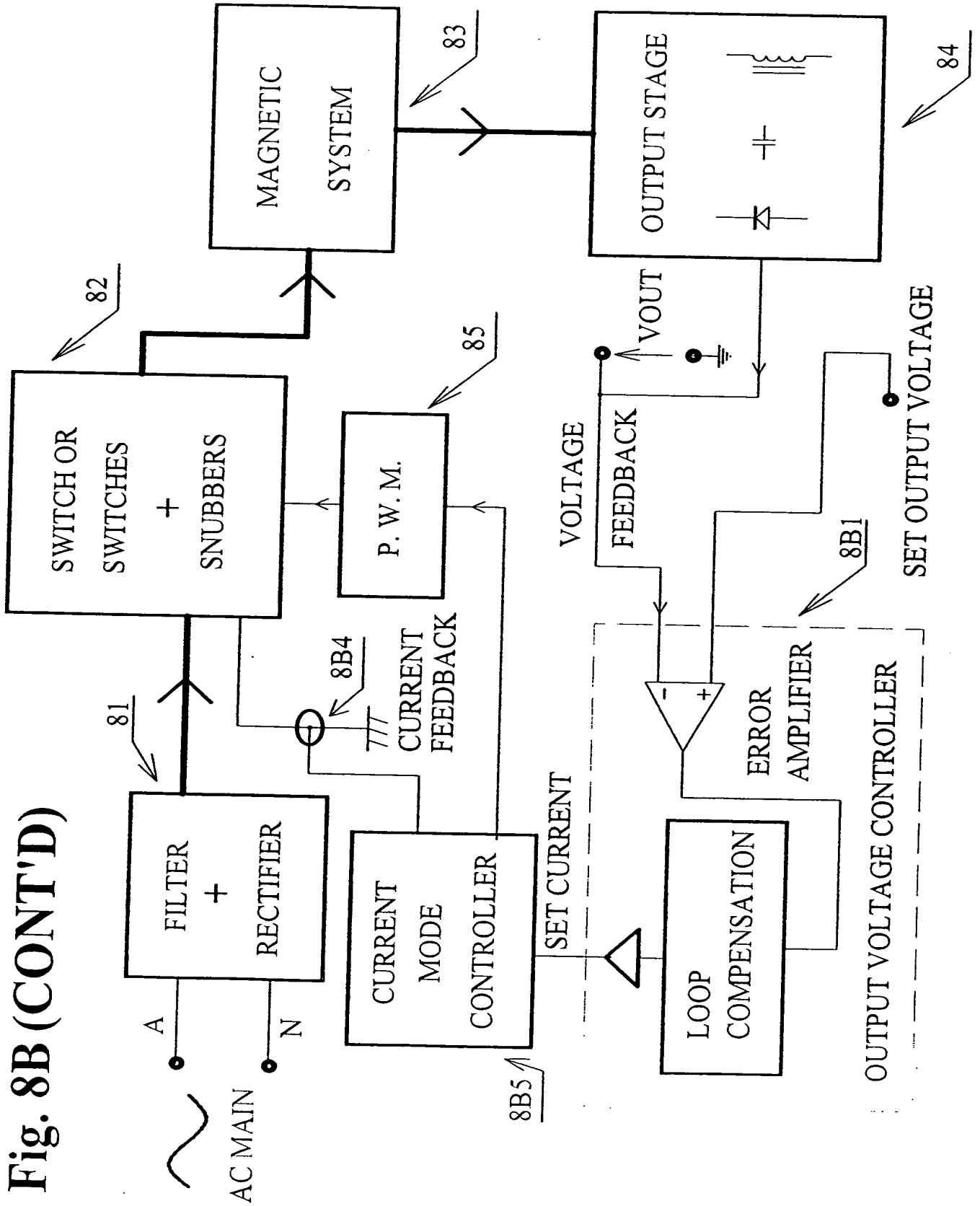

AC MAIN
A
N
81
FILTER + RECTIFIER
82
SWITCH OR SWITCHES + SNUBBERS
83
MAGNETIC SYSTEM
84
OUTPUT STAGE
VOUT
85
P. W. M.
8B4
CURRENT FEEDBACK
8B5
CURRENT MODE CONTROLLER
SET CURRENT
VOLTAGE FEEDBACK
8B1
ERROR AMPLIFIER
LOOP COMPENSATION
SET OUTPUT VOLTAGE
OUTPUT VOLTAGE CONTROLLER

Fig. 8C

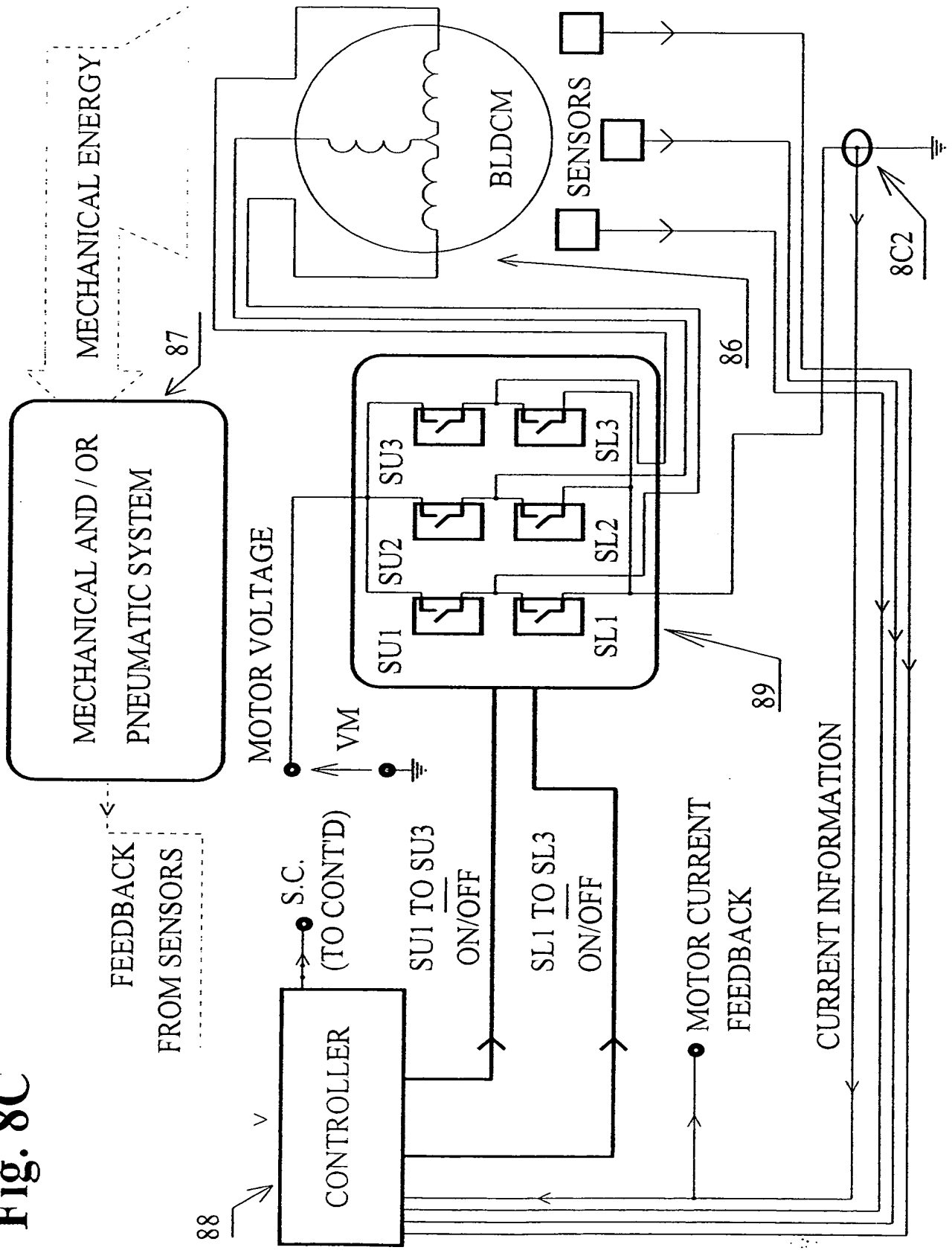

MECHANICAL ENERGY
87
MECHANICAL AND / OR
PNEUMATIC SYSTEM
FEEDBACK
FROM SENSORS
MOTOR VOLTAGE
VM
S.C.
(TO CONT'D)
SU1 TO SU3
ON/OFF
SL1 TO SL3
ON/OFF
MOTOR CURRENT
FEEDBACK
CURRENT INFORMATION
CONTROLLER
88
V
SU1
SU2
SU3
SL1
SL2
SL3
89
BLDCM
SENSORS
86
8C2

Fig. 8C (CONT'D)

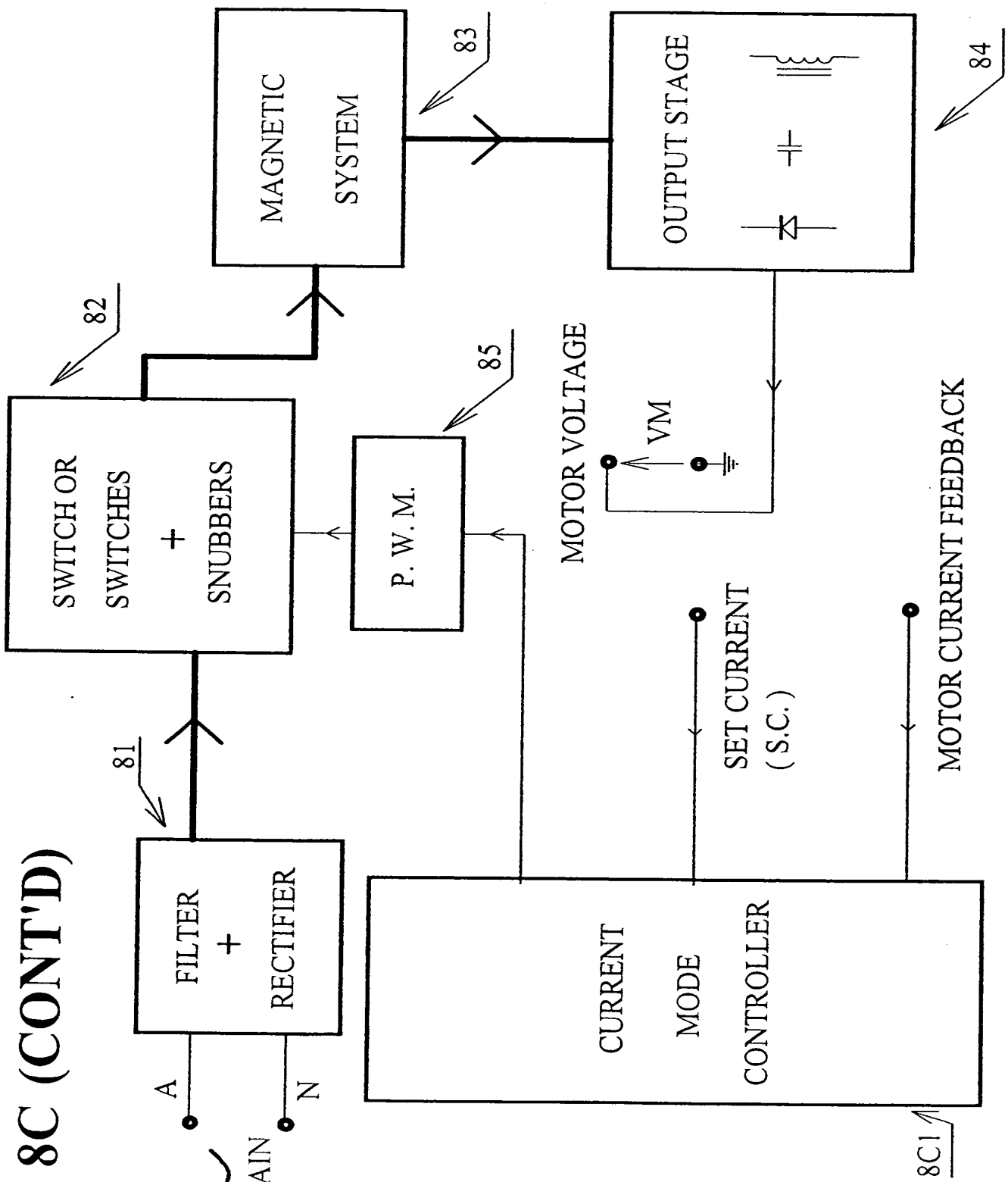
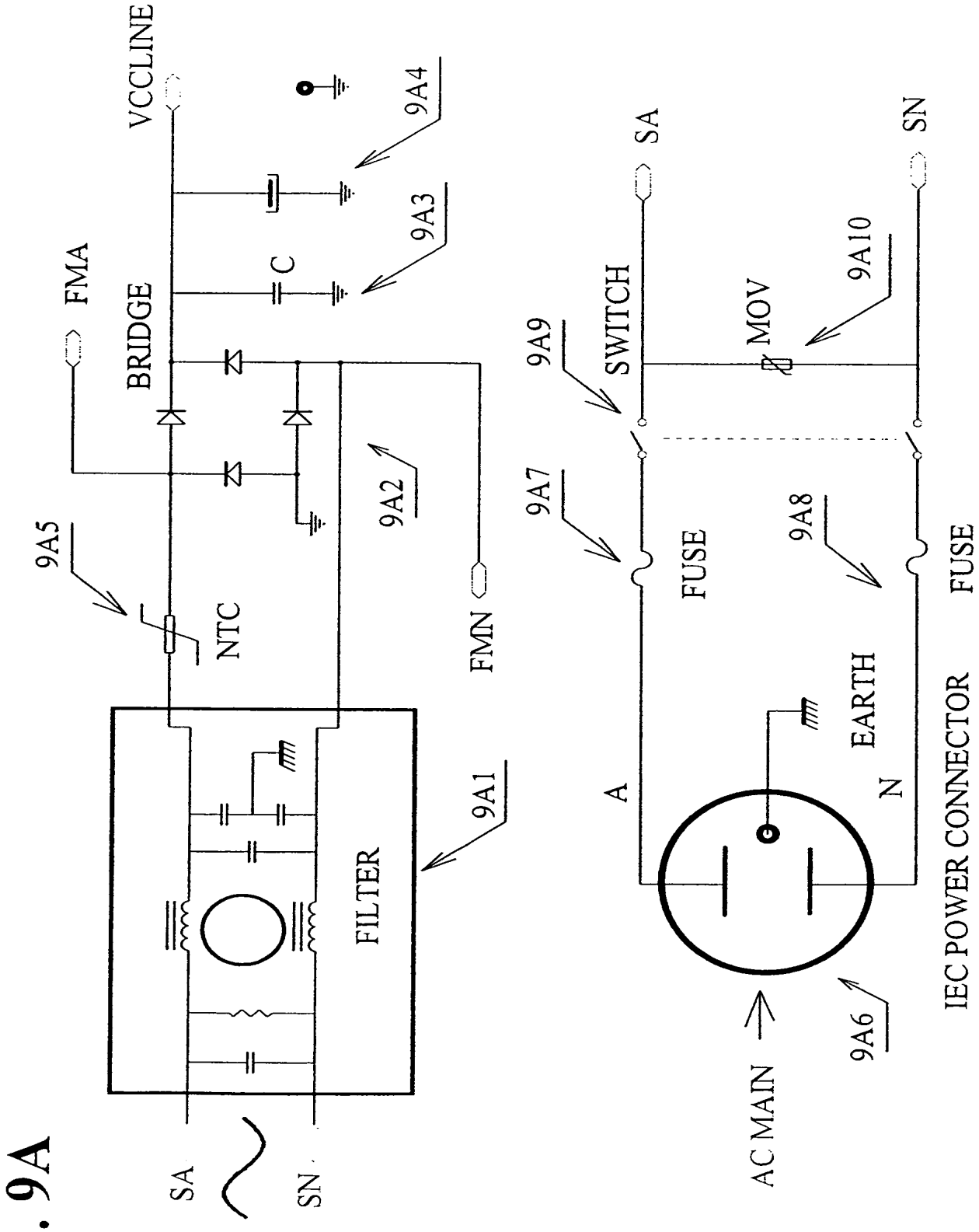

AC MAIN
A
N
81
FILTER + RECTIFIER
82
SWITCH OR SWITCHES + SNUBBERS
MAGNETIC SYSTEM
83
OUTPUT STAGE
84
P. W. M.
85
MOTOR VOLTAGE
VM
SET CURRENT (S.C.)
MOTOR CURRENT FEEDBACK
CURRENT MODE CONTROLLER
8C1

Fig. 9A


VCCLINE
9A4
9A3
FMA
BRIDGE
C
9A5
9A2
NTC
FMN
9A1
FILTER
SA
SN
9A9
SWITCH
SA
SN
9A10
MOV
9A7
FUSE
9A8
FUSE
A
EARTH
N
AC MAIN
9A6
IEC POWER CONNECTOR

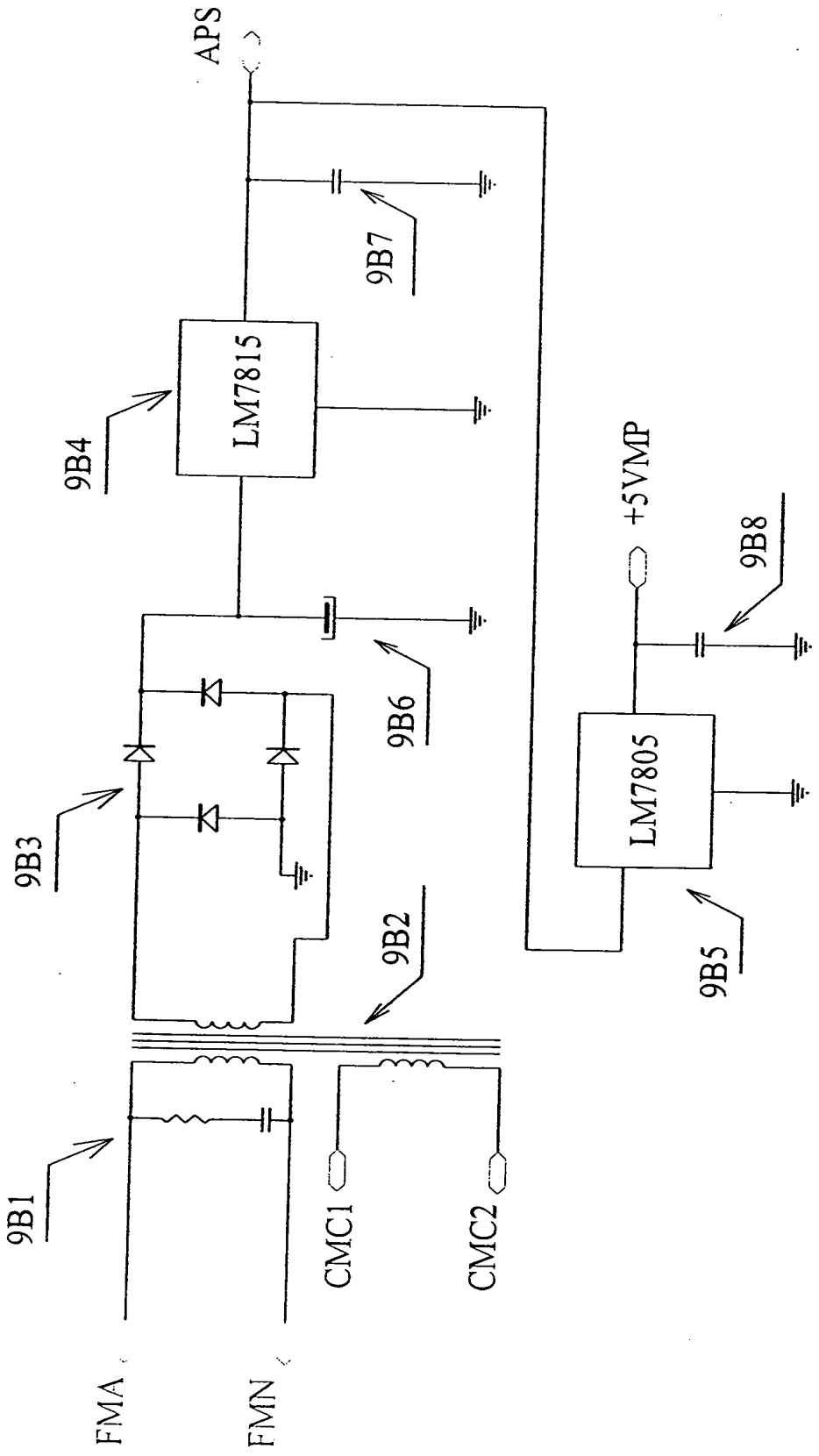

APS
9B7
LM7815
9B4
+5VMP
9B8
9B6
9B3
LM7805
9B2
9B5
9B1
CMC1
CMC2
FMA
FMN

Fig. 9B

Fig. 9C

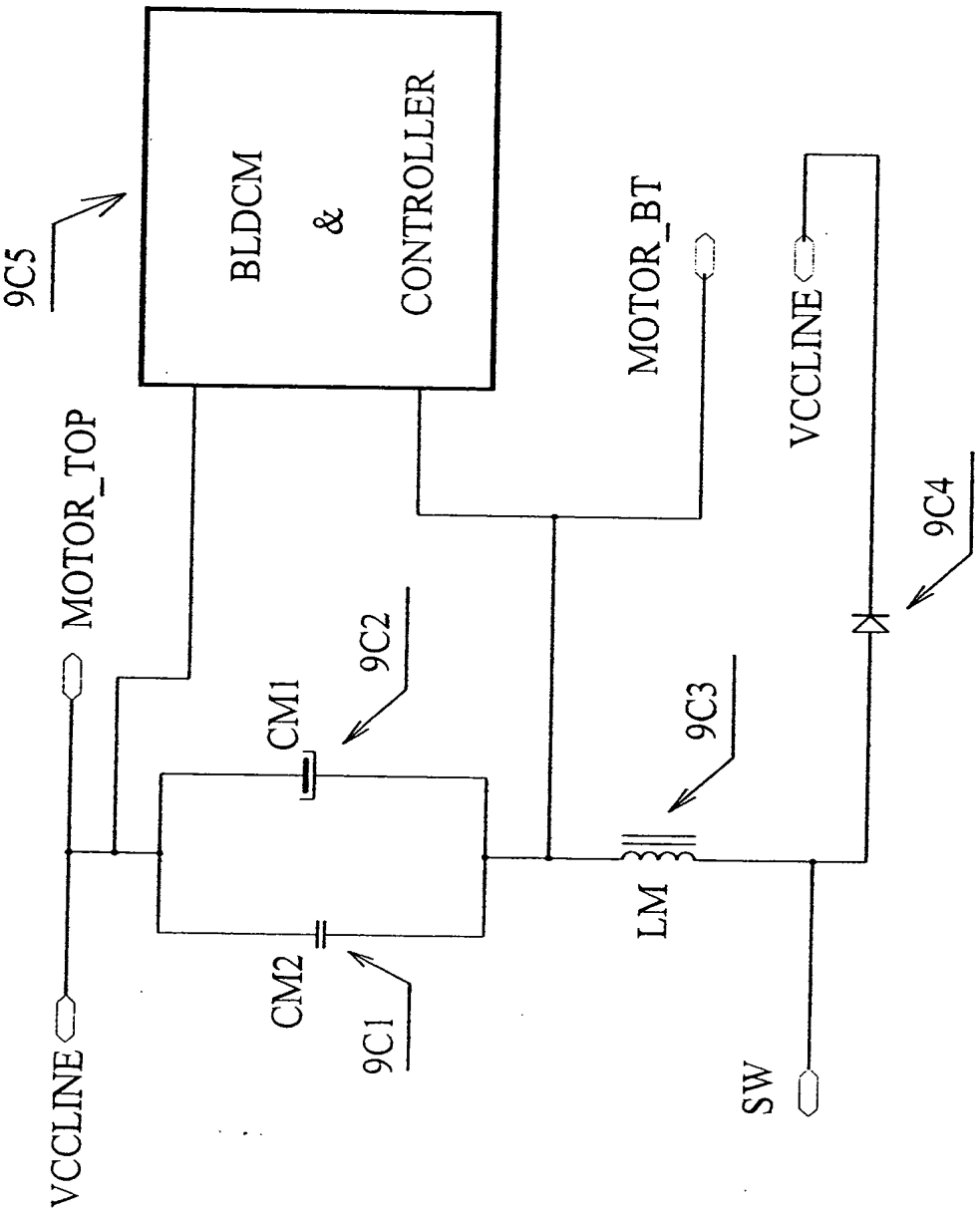
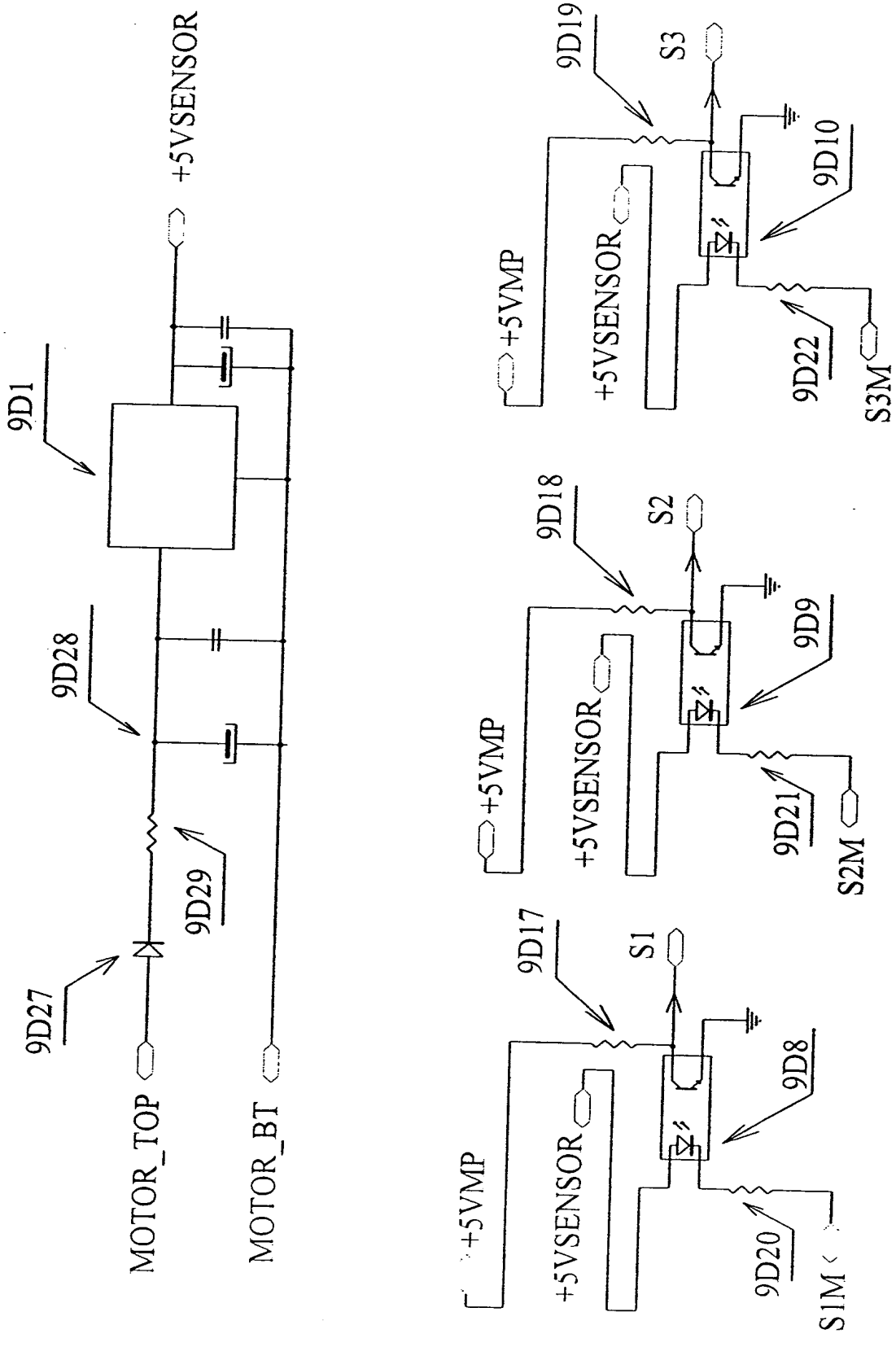

BLDCM
&
CONTROLLER
9C5
MOTOR_TOP
MOTOR_BT
VCCLINE
9C4
CM1
9C2
9C3
LM
CM2
9C1
VCCLINE
SW

Fig. 9D


+5VSENSOR
9D1
9D28
9D29
9D27
MOTOR_TOP
MOTOR_BT
9D19
S3
9D10
+5VMP
+5VSENSOR
9D22
S3M
9D18
S2
9D9
+5VMP
+5VSENSOR
9D21
S2M
9D17
S1
9D8
+5VMP
+5VSENSOR
9D20
S1M

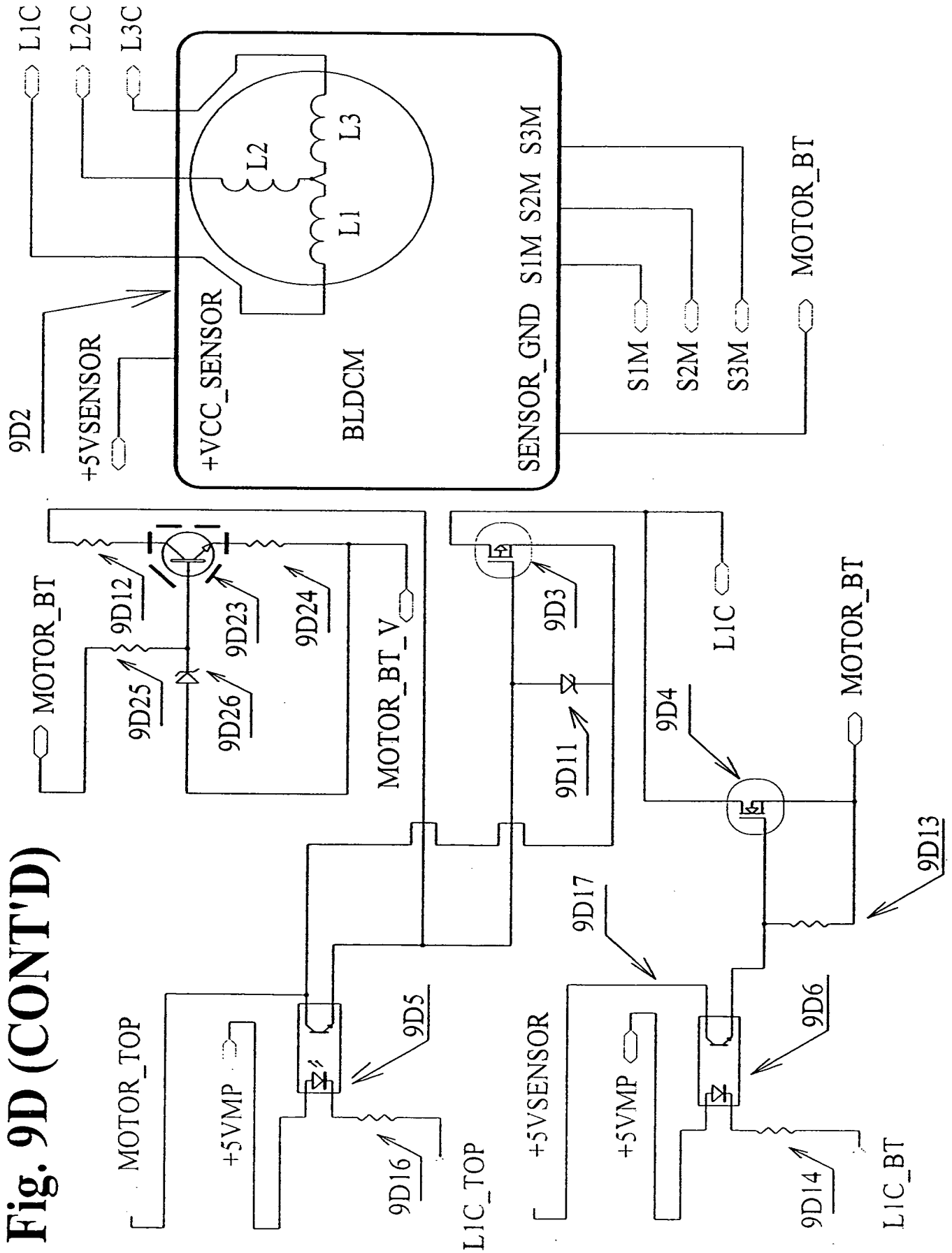

L1C
L2C
L3C
9D2
+5VSENSOR
+VCC_SENSOR
L2
L3
L1
BLDCM
SENSOR_GND S1M S2M S3M
S1M
S2M
S3M
MOTOR_BT
MOTOR_BT
9D12
9D23
9D24
9D25
9D26
MOTOR_BT_V
9D3
9D11
L1C
9D4
MOTOR_BT
9D13
9D17
MOTOR_TOP
+5VMP
9D5
9D16
L1C_TOP
+5VSENSOR
+5VMP
9D6
9D14
L1C_BT

Fig. 9D (CONT'D)

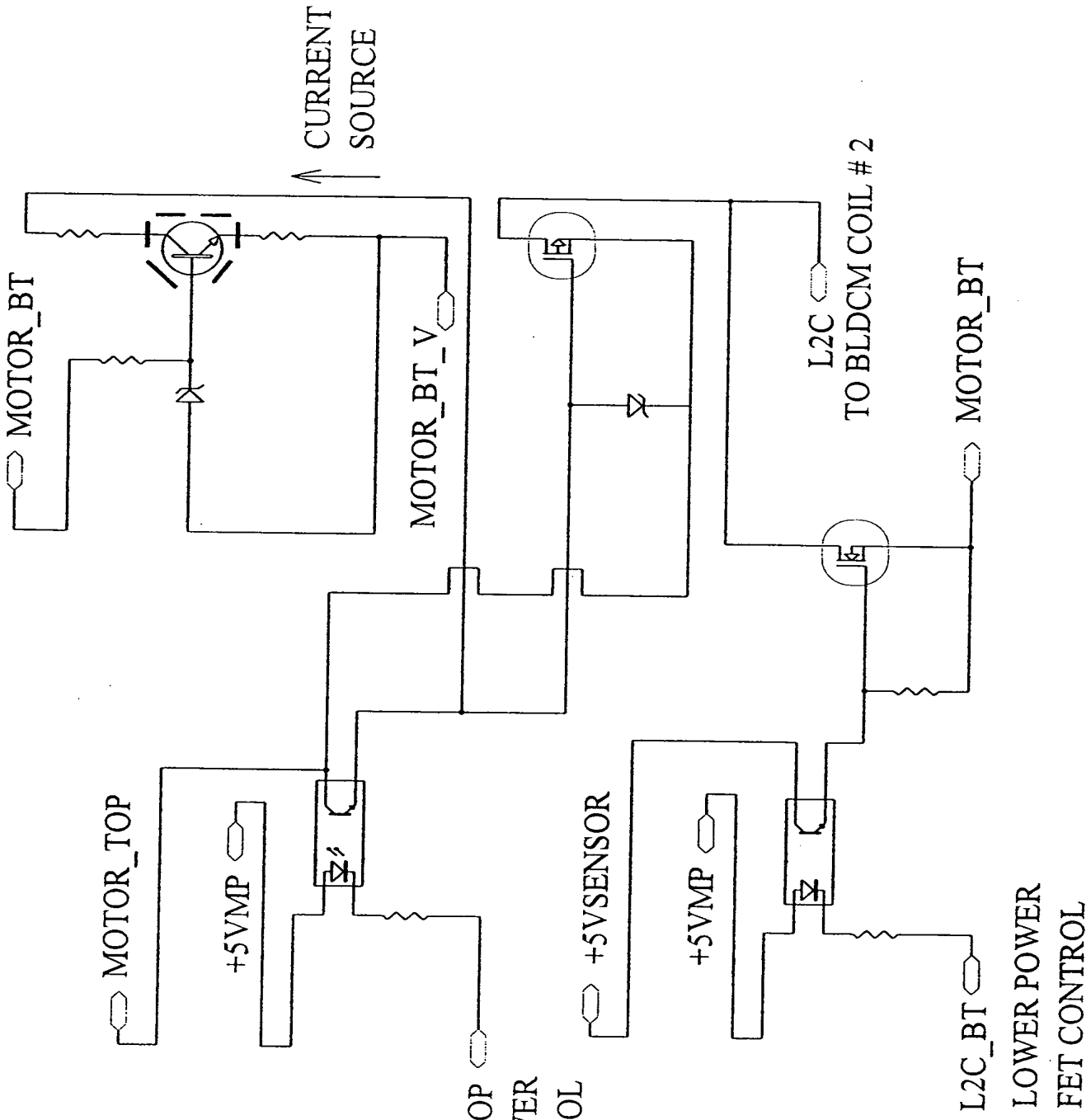

CURRENT SOURCE
MOTOR_BT
MOTOR_BT_V
L2C TO BLDCM COIL # 2
MOTOR_BT
MOTOR_TOP
+5VMP
L2C_TOP UPPER POWER FET CONTROL
+5VSENSOR
+5VMP
L2C_BT LOWER POWER FET CONTROL

Fig. 9E

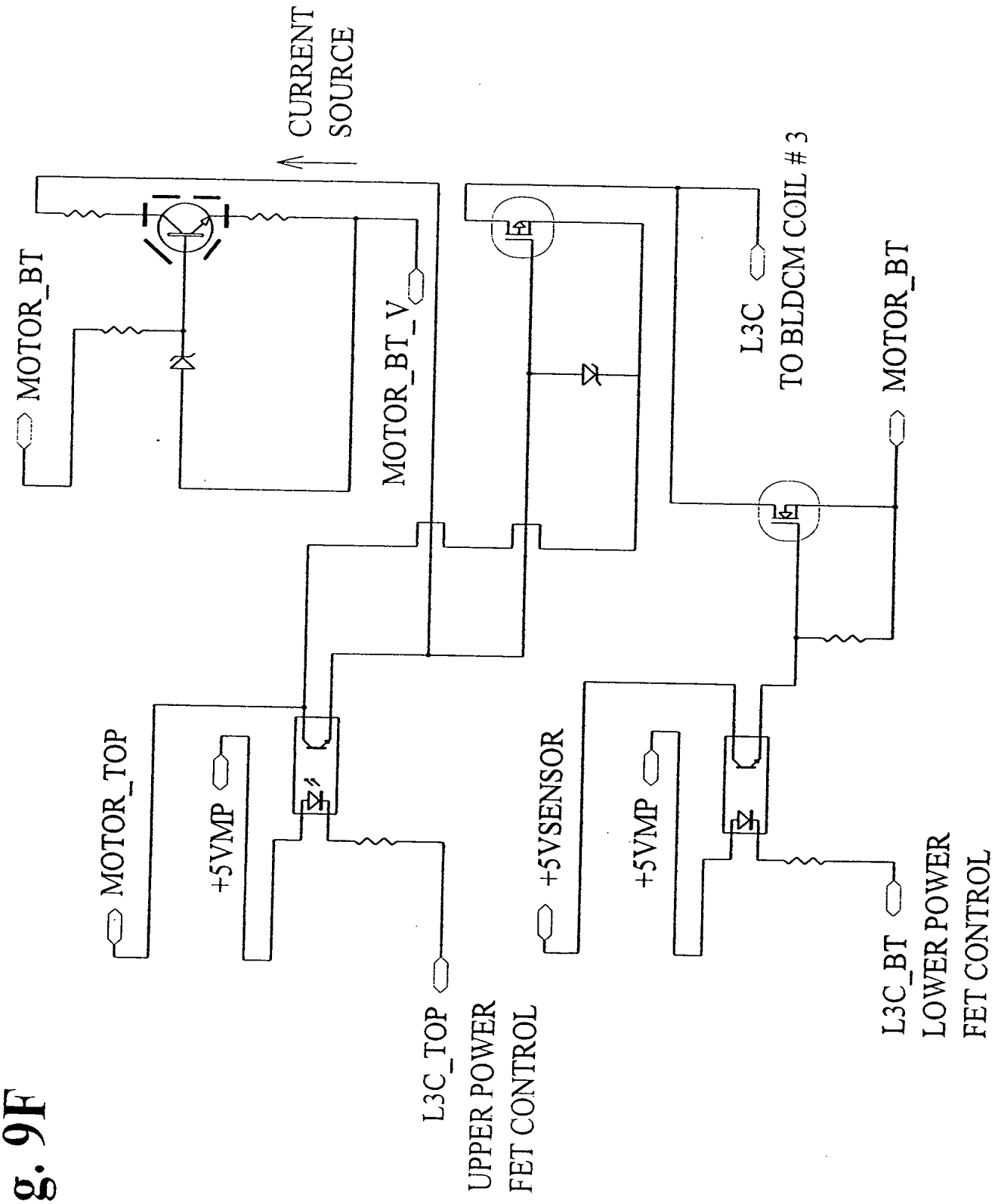

CURRENT SOURCE
MOTOR_BT
MOTOR_BT_V
L3C TO BLDCM COIL # 3
MOTOR_BT
MOTOR_TOP
+5VMP
L3C_TOP UPPER POWER FET CONTROL
+5VSENSOR
+5VMP
L3C_BT LOWER POWER FET CONTROL

Fig. 9F

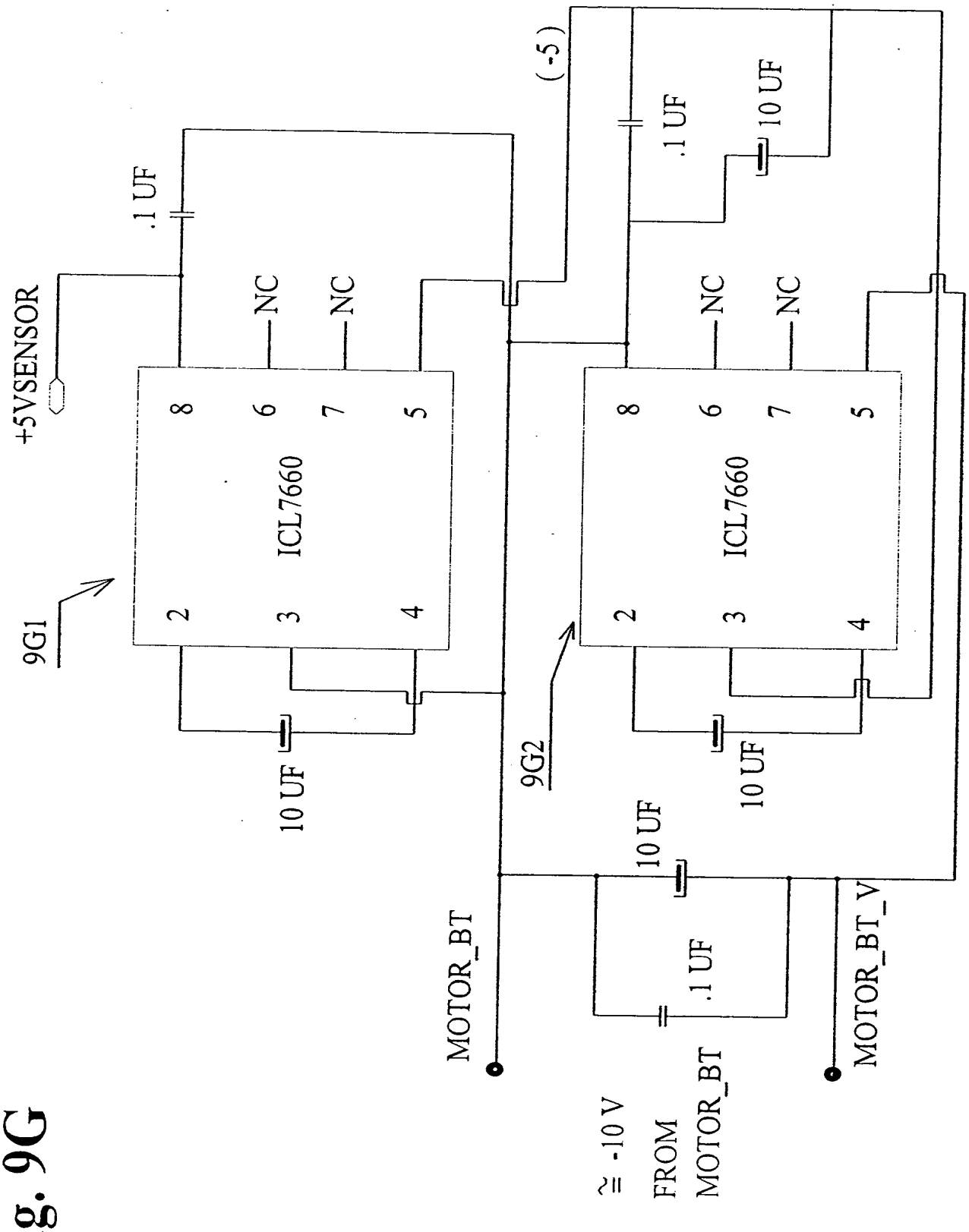

+5VSENSOR
.1 UF
NC
NC
8
6
7
5
ICL7660
2
3
4
9G1
10 UF
(-5)
.1 UF
10 UF
NC
NC
8
6
7
5
ICL7660
2
3
4
9G2
10 UF
10 UF
.1 UF
MOTOR_BT
≅ -10 V
FROM
MOTOR_BT
MOTOR_BT_V

Fig. 9G

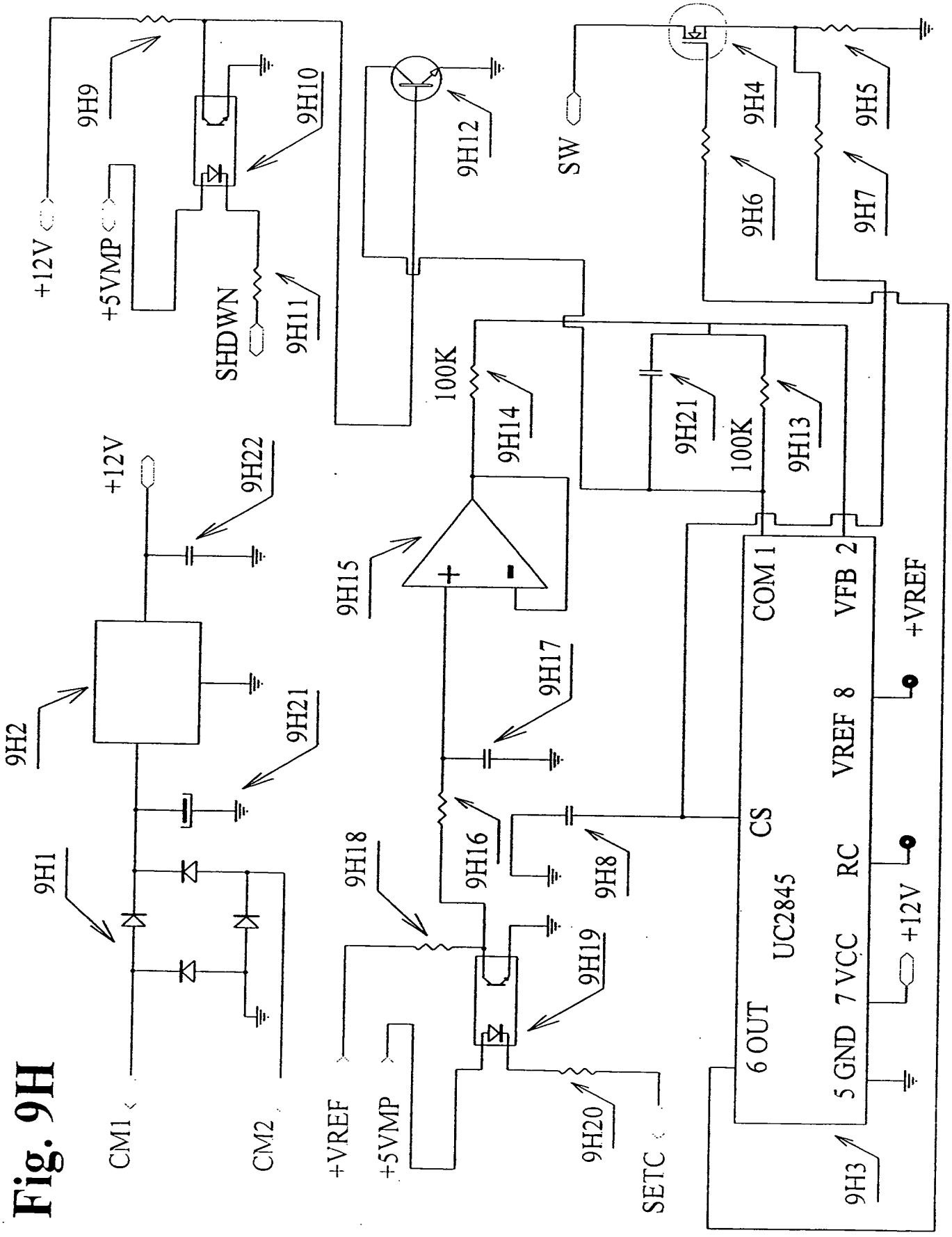

+12V
9H9
+5VMP
9H10
SHDWN
9H11
9H12
SW
9H4
9H5
9H6
9H7
100K
9H14
9H21
100K
9H13
9H15
+12V
9H22
9H2
9H21
9H17
9H1
9H18
9H16
9H8
9H19
CM1
CM2
+VREF
+5VMP
9H20
SETC
COM 1
VFB 2
+VREF
CS
VREF 8
RC
+12V
6 OUT
UC2845
5 GND
7 VCC
9H3

Fig. 9H

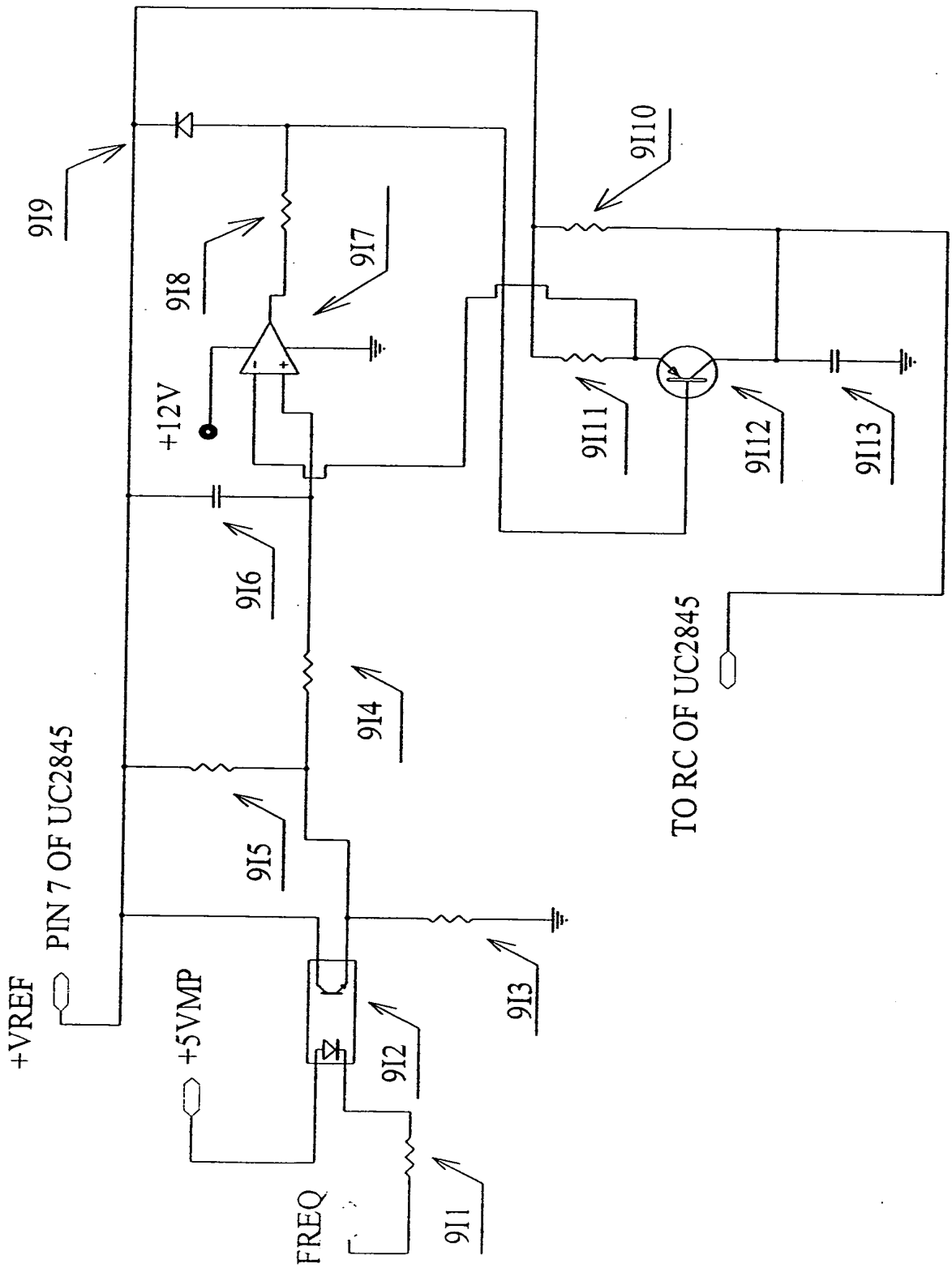

9I9
9I8
9I7
9I10
+12V
9I11
9I12
9I13
9I6
9I4
9I5
9I3
9I2
9I1
+VREF
PIN 7 OF UC2845
+5VMP
FREQ
TO RC OF UC2845

Fig. 9I

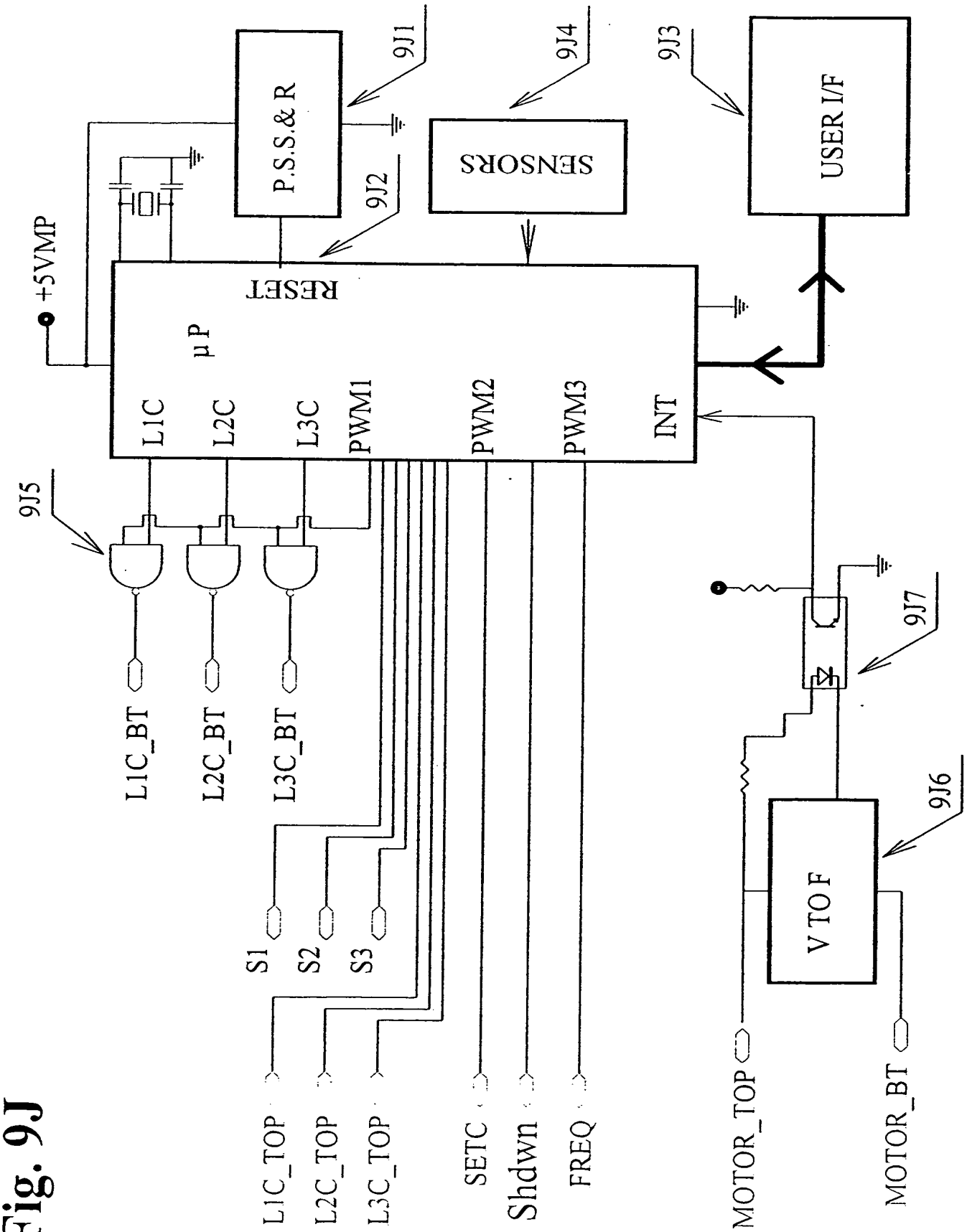

9J1
9J4
9J3
P.S.S.& R
SENSORS
USER I/F
9J2
+5VMP
RESET
μP
L1C
L2C
L3C
PWM1
PWM2
PWM3
INT
9J5
9J7
9J6
V TO F
L1C_BT
L2C_BT
L3C_BT
S1
S2
S3
L1C_TOP
L2C_TOP
L3C_TOP
SETC
Shdwn
FREQ
MOTOR_TOP
MOTOR_BT

Fig. 9J

Fig. 9K

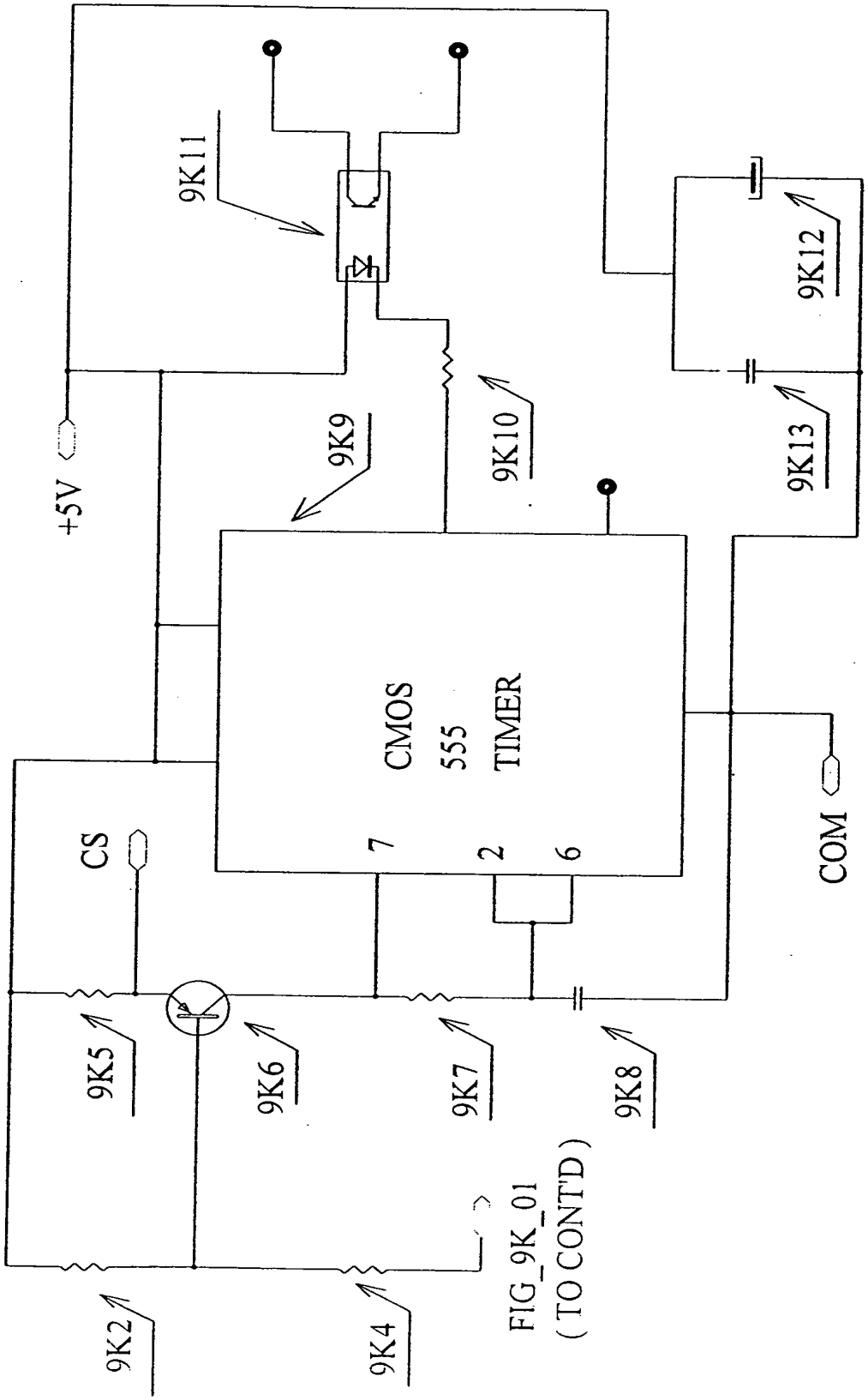
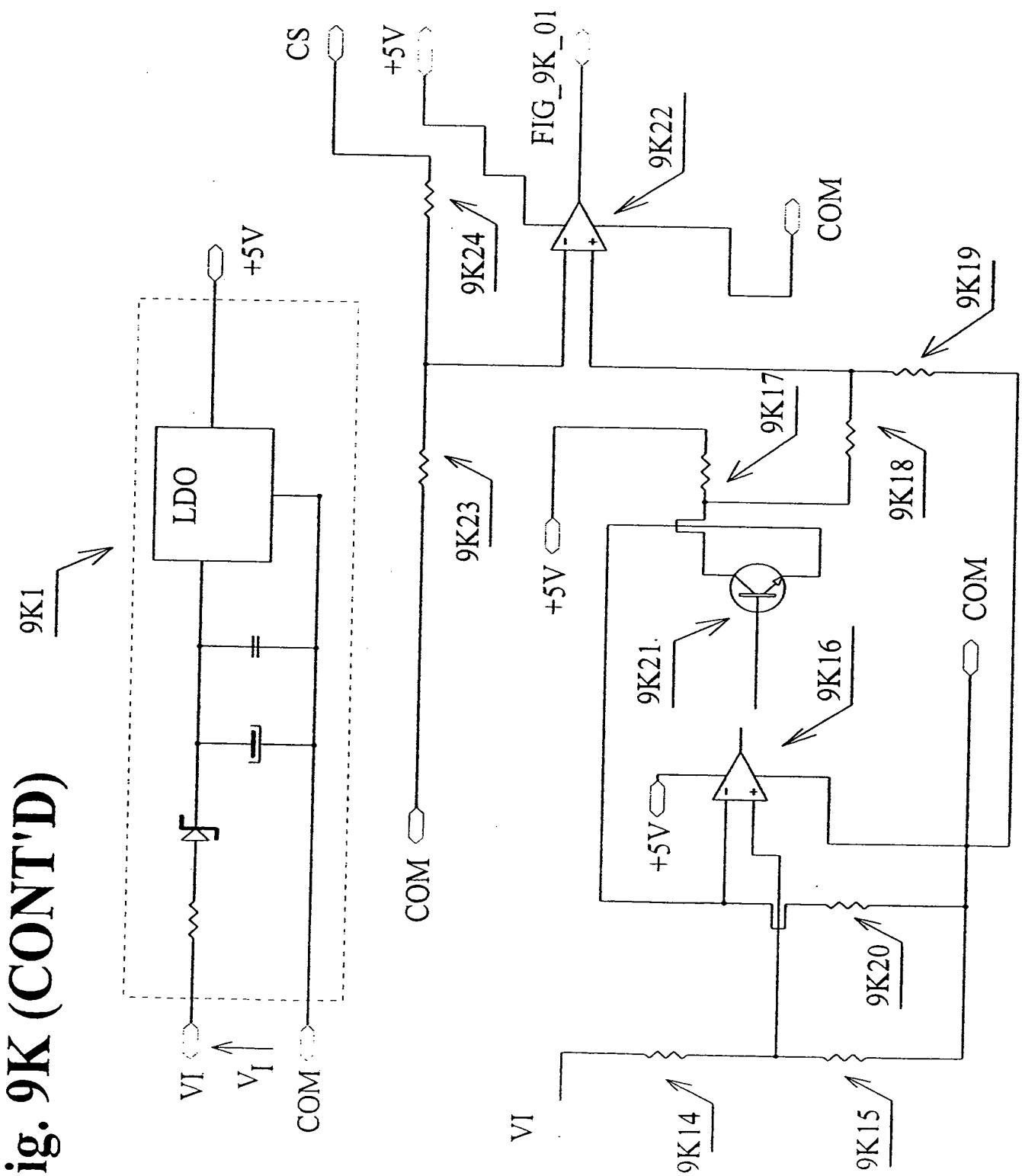

9K11
9K12
+5V
9K9
9K10
9K13
CMOS
555
TIMER
7
2
6
CS
COM
9K5
9K6
9K7
9K8
9K2
9K4
FIG_9K_01
(TO CONT'D)

Fig. 9K (CONT'D)


9K1
LDO
+5V
VI
V_I
COM
CS
+5V
FIG_9K_01
9K22
9K24
COM
9K19
9K17
9K18
9K23
+5V
9K21
9K16
COM
+5V
9K20
VI
9K14
9K15

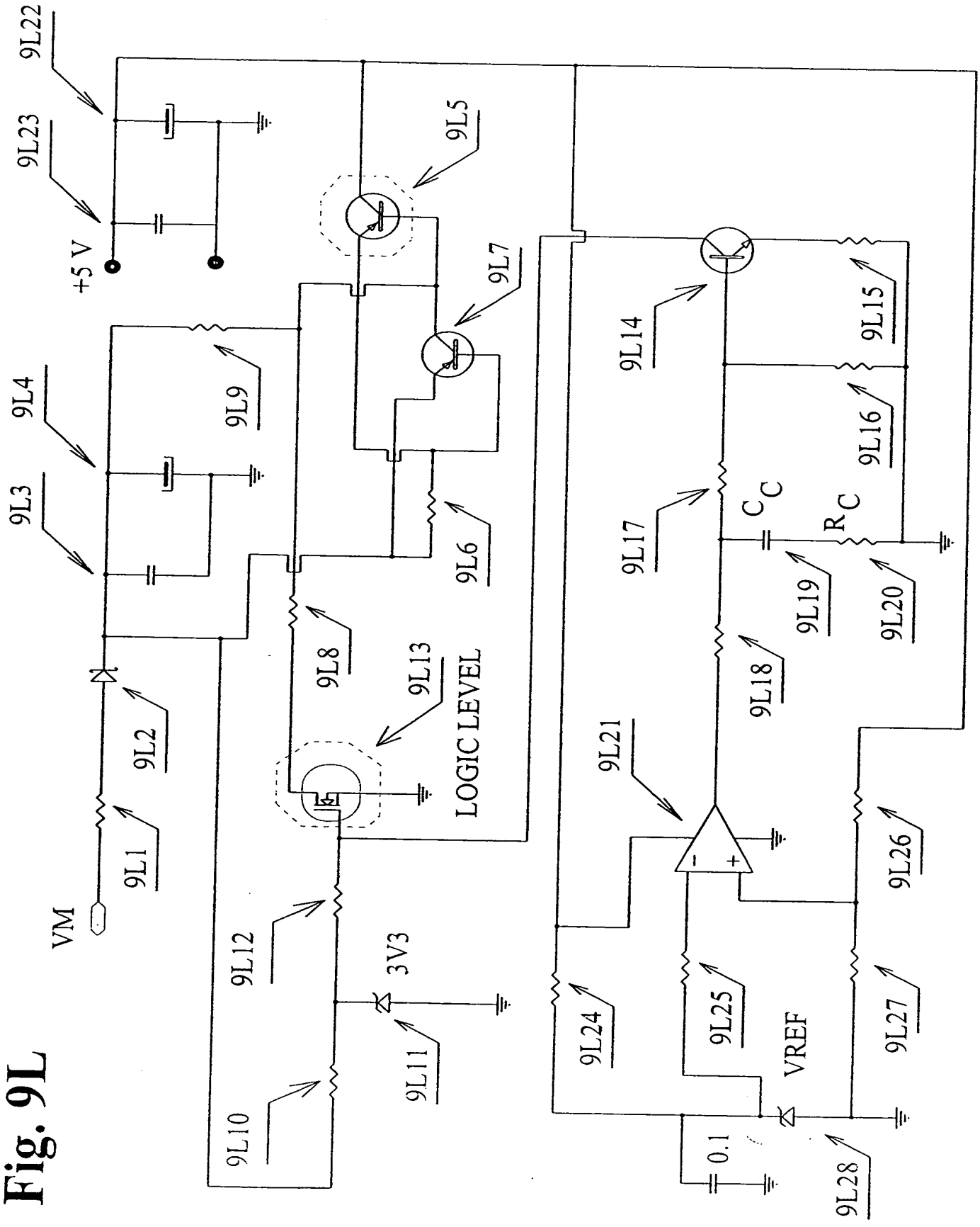

9L22
9L23
+5 V
9L5
9L7
9L4
9L9
9L3
9L6
9L8
9L13
LOGIC LEVEL
9L2
9L1
VM
9L12
3V3
9L11
9L10
9L14
9L15
9L16
C_C
R_C
9L17
9L19
9L20
9L18
9L21
9L26
9L24
9L25
VREF
9L27
0.1
9L28

Fig. 9L

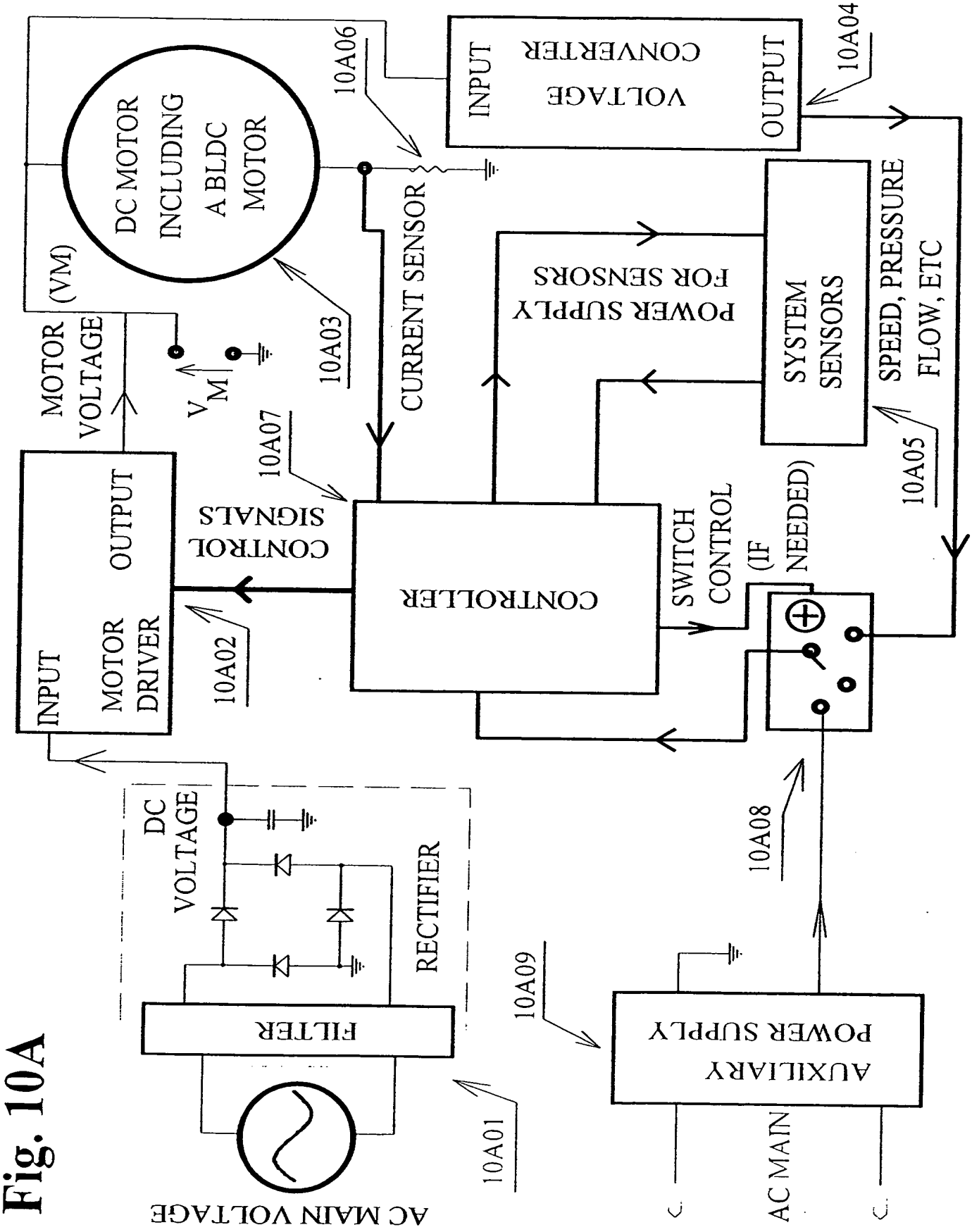
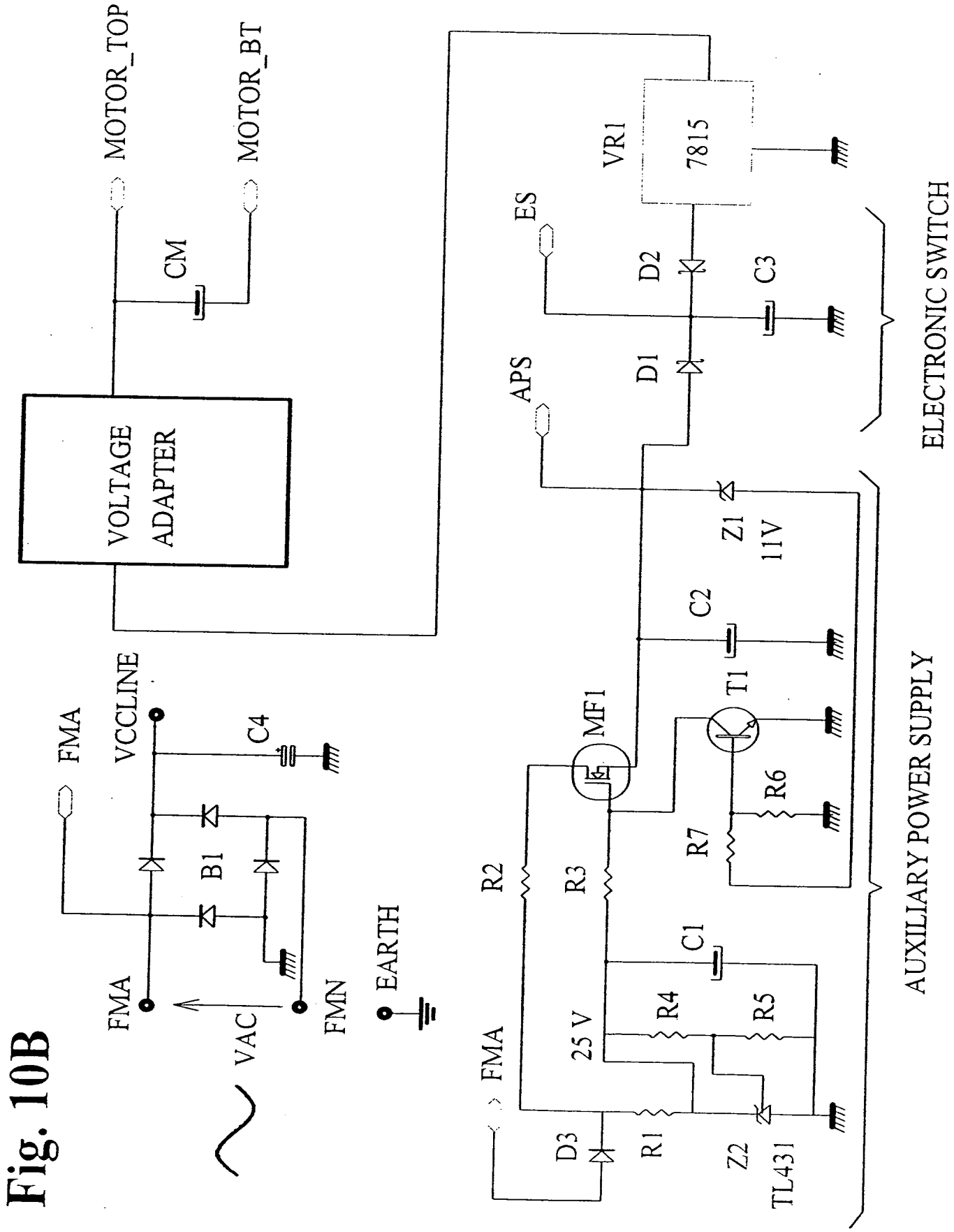

AC MAIN VOLTAGE
FILTER
RECTIFIER
DC VOLTAGE
10A01
AUXILIARY POWER SUPPLY
10A09
AC MAIN
10A08
INPUT MOTOR DRIVER OUTPUT
10A02
CONTROL SIGNALS
CONTROLLER
SWITCH CONTROL (IF NEEDED)
10A07
MOTOR VOLTAGE (VM)
V_M
10A03
DC MOTOR INCLUDING A BLDC MOTOR
CURRENT SENSOR
10A06
INPUT VOLTAGE CONVERTER OUTPUT
10A04
POWER SUPPLY FOR SENSORS
SYSTEM SENSORS
SPEED, PRESSURE FLOW, ETC
10A05

Fig. 10A

Fig. 10B


MOTOR_TOP
MOTOR_BT
CM
VOLTAGE ADAPTER
FMA
VCCLINE
C4
B1
FMA
VAC
FMN
EARTH
ES
VR1
7815
D2
C3
APS
D1
Z1
11V
C2
MF1
T1
R6
R7
R2
R3
C1
25 V
R4
R5
FMA
D3
R1
Z2
TL431
AUXILIARY POWER SUPPLY
ELECTRONIC SWITCH

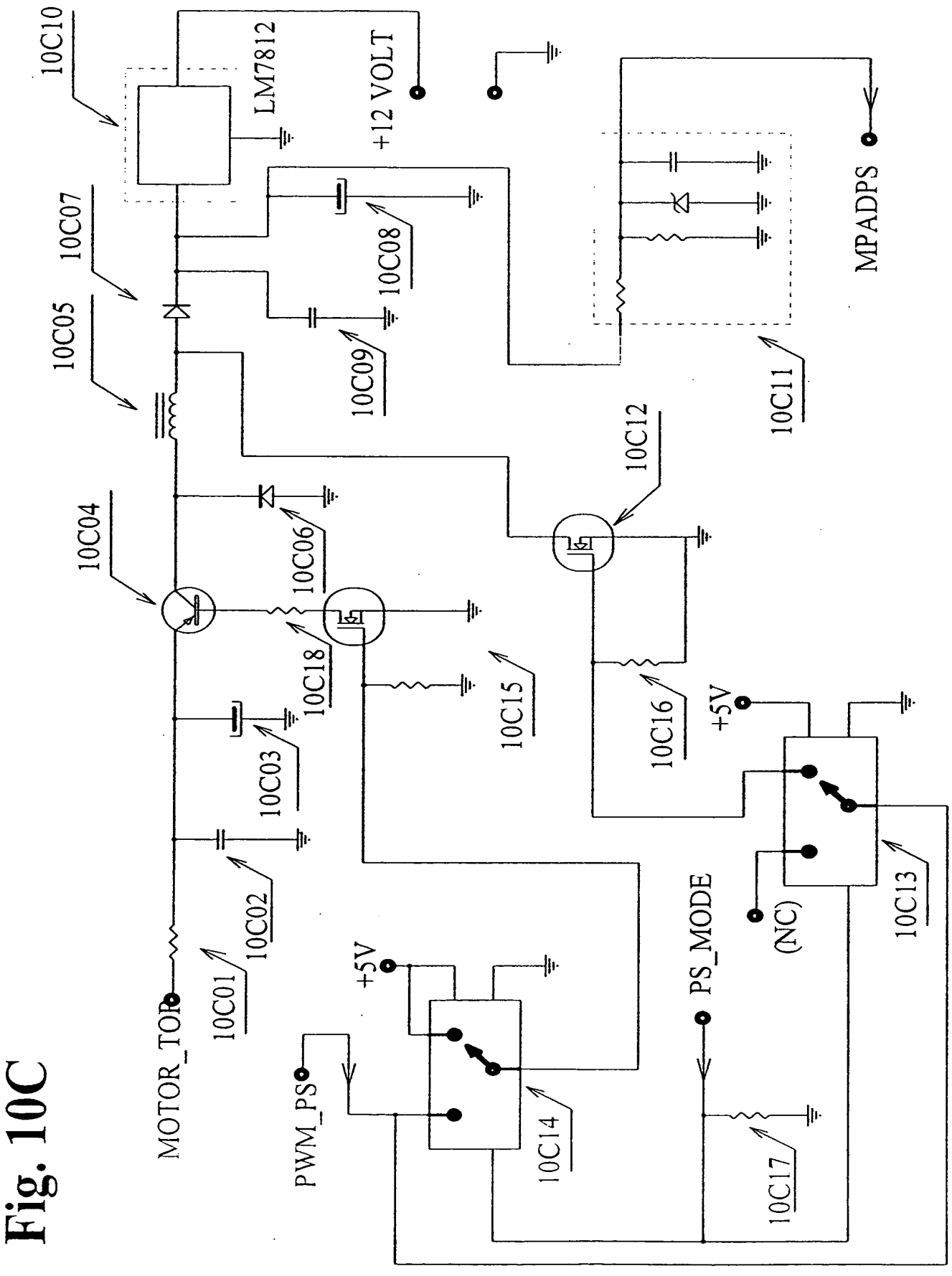

10C10
LM7812
+12 VOLT
10C07
10C08
10C05
10C09
MPADPS
10C11
10C12
10C04
10C06
10C18
10C15
10C16
+5V
10C03
10C02
10C01
MOTOR_TOR
+5V
PWM_PS
10C14
PS_MODE
(NC)
10C13
10C17

Fig. 10C

Fig. 10D

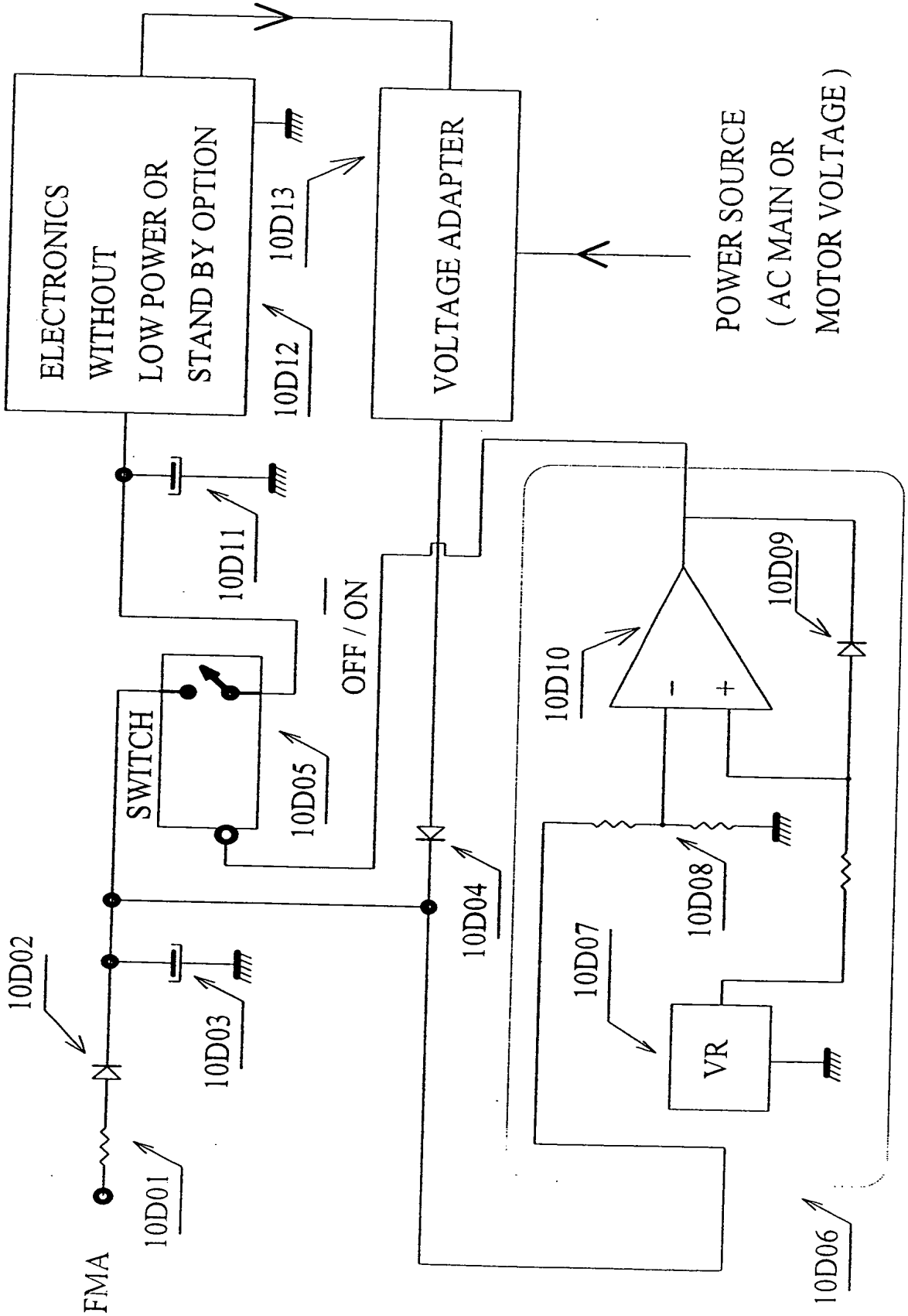
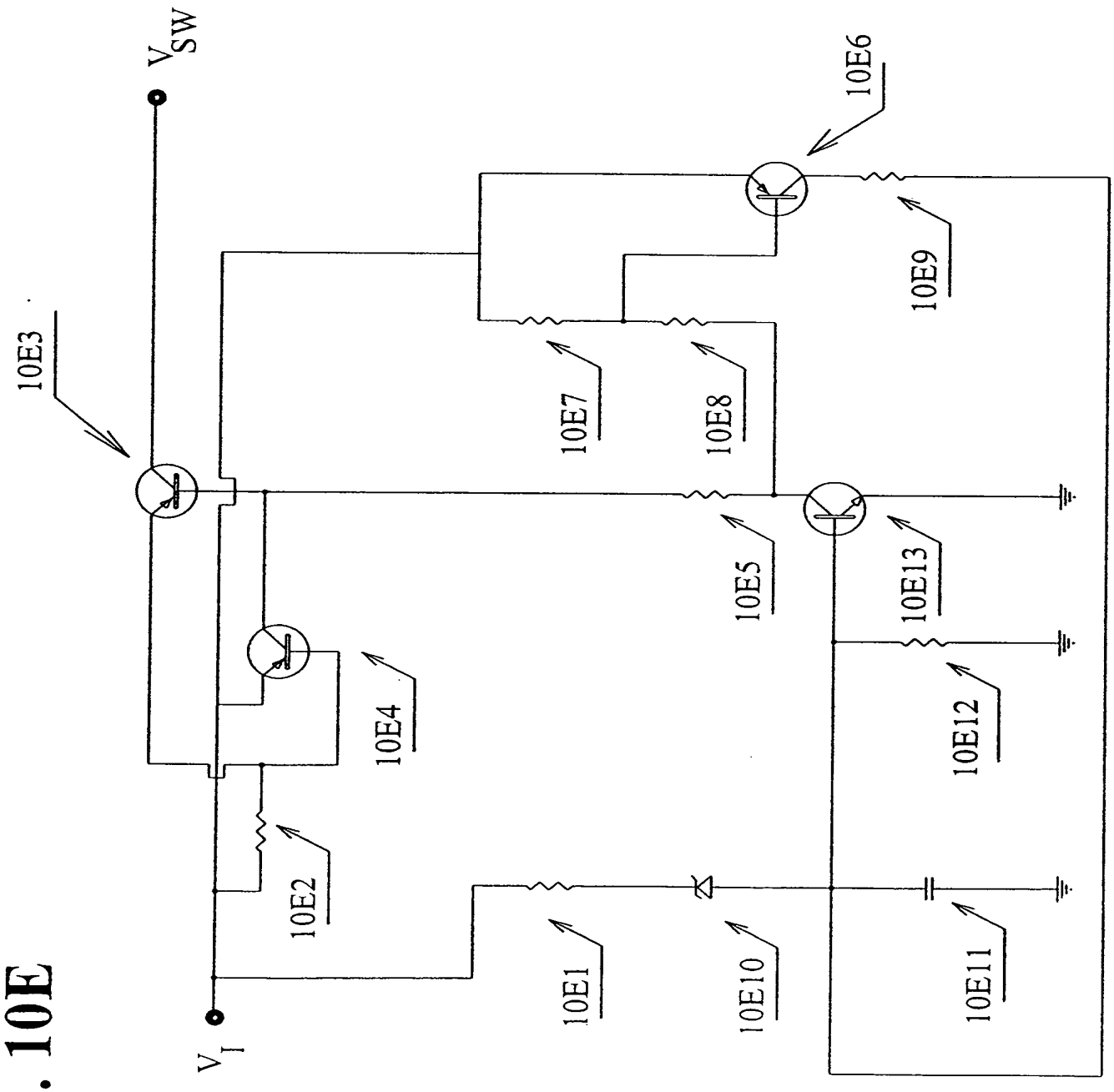

ELECTRONICS WITHOUT LOW POWER OR STAND BY OPTION
VOLTAGE ADAPTER
POWER SOURCE (AC MAIN OR MOTOR VOLTAGE)
10D01
10D02
10D03
10D04
10D05
10D06
10D07
10D08
10D09
10D10
10D11
10D12
10D13
FMA
SWITCH
OFF / ON
VR

Fig. 10E


V_{SW}
V_I
10E1
10E2
10E3
10E4
10E5
10E6
10E7
10E8
10E9
10E10
10E11
10E12
10E13

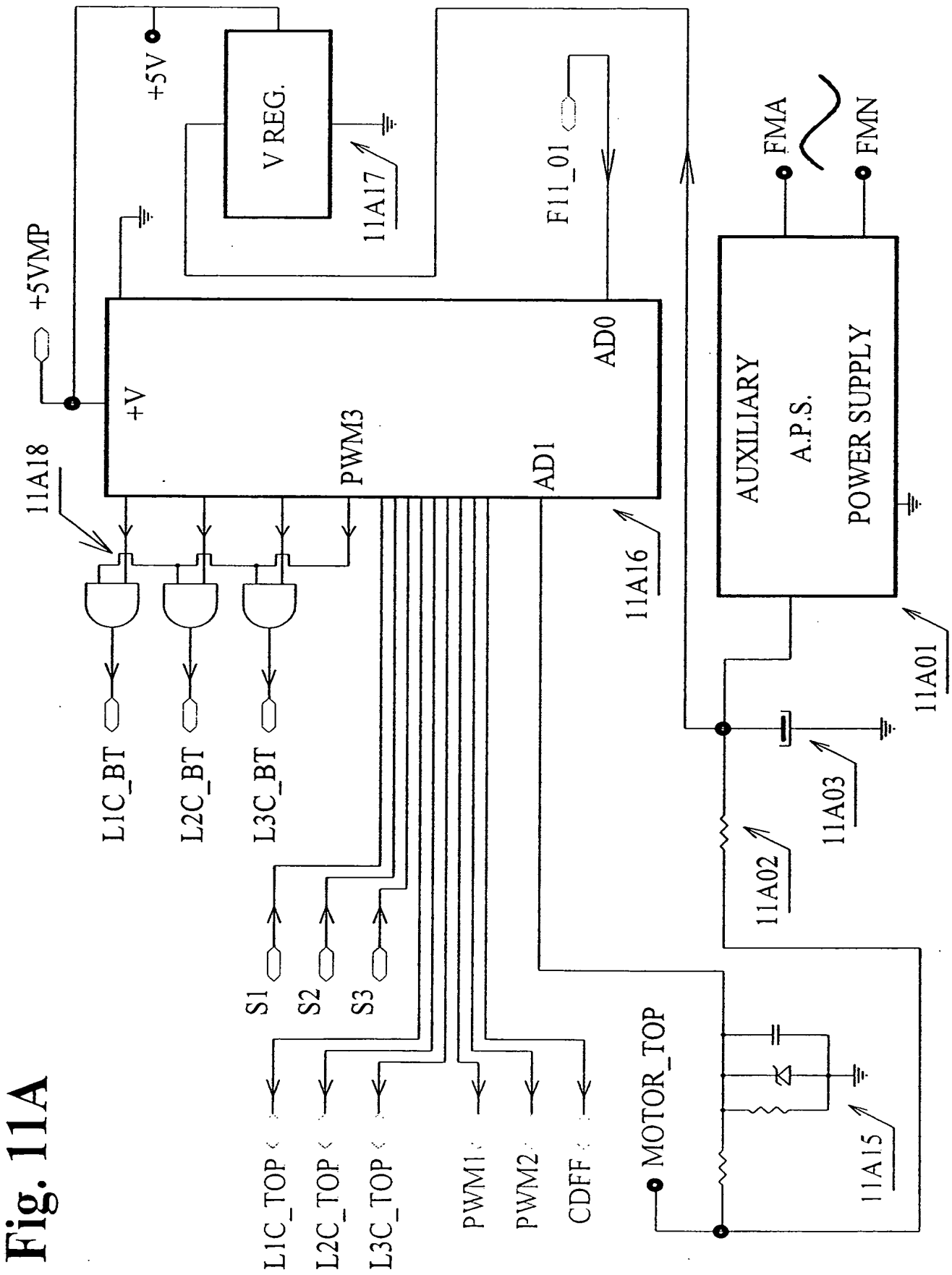
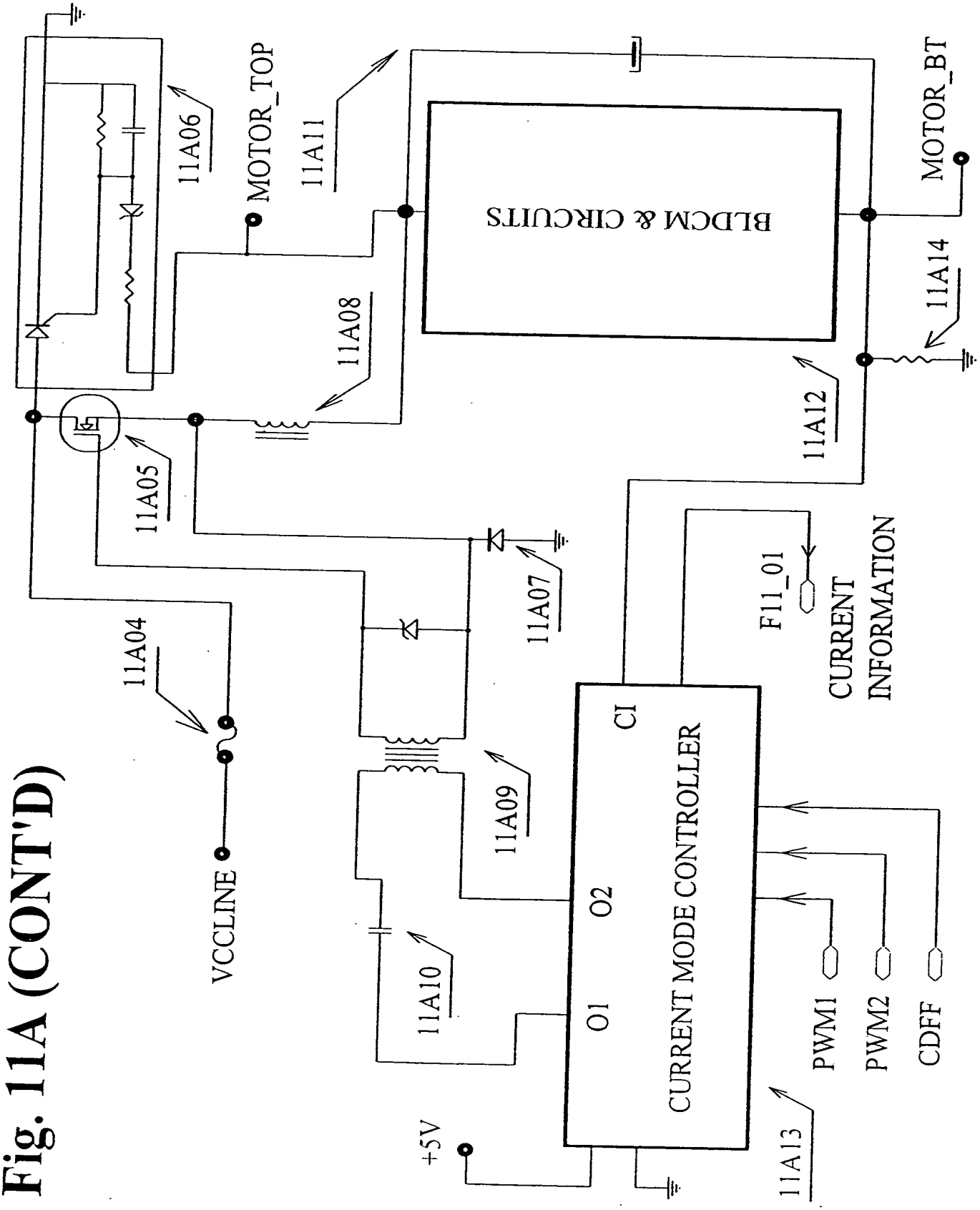

+5V
V REG.
11A17
F11_01
FMA
FMN
+5VMP
+V
AD0
AUXILIARY
A.P.S.
POWER SUPPLY
11A18
PWM3
AD1
11A16
11A01
L1C_BT
L2C_BT
L3C_BT
11A03
11A02
S1
S2
S3
MOTOR_TOP
L1C_TOP
L2C_TOP
L3C_TOP
PWM1
PWM2
CDFF
11A15

Fig. 11A

Fig. 11A (CONT'D)



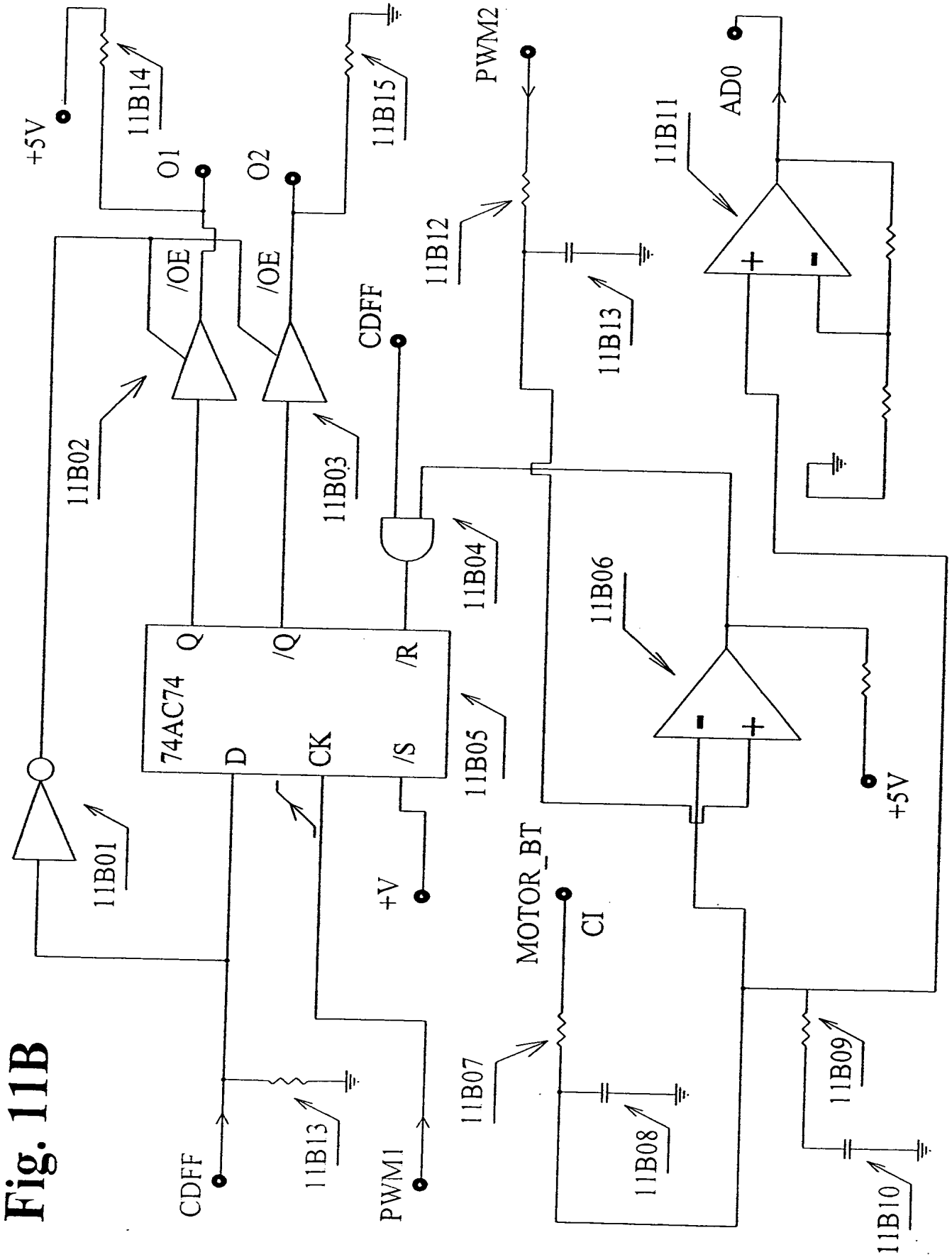

+5V
11B14
O1
O2
11B15
PWM2
AD0
11B11
/OE
/OE
CDFF
11B12
11B13
11B02
11B03
11B04
11B06
74AC74
Q
/Q
/R
D
CK
/S
11B05
11B01
+V
MOTOR_BT
CI
+5V
11B07
11B08
11B09
CDFF
11B13
PWM1
11B10

Fig. 11B

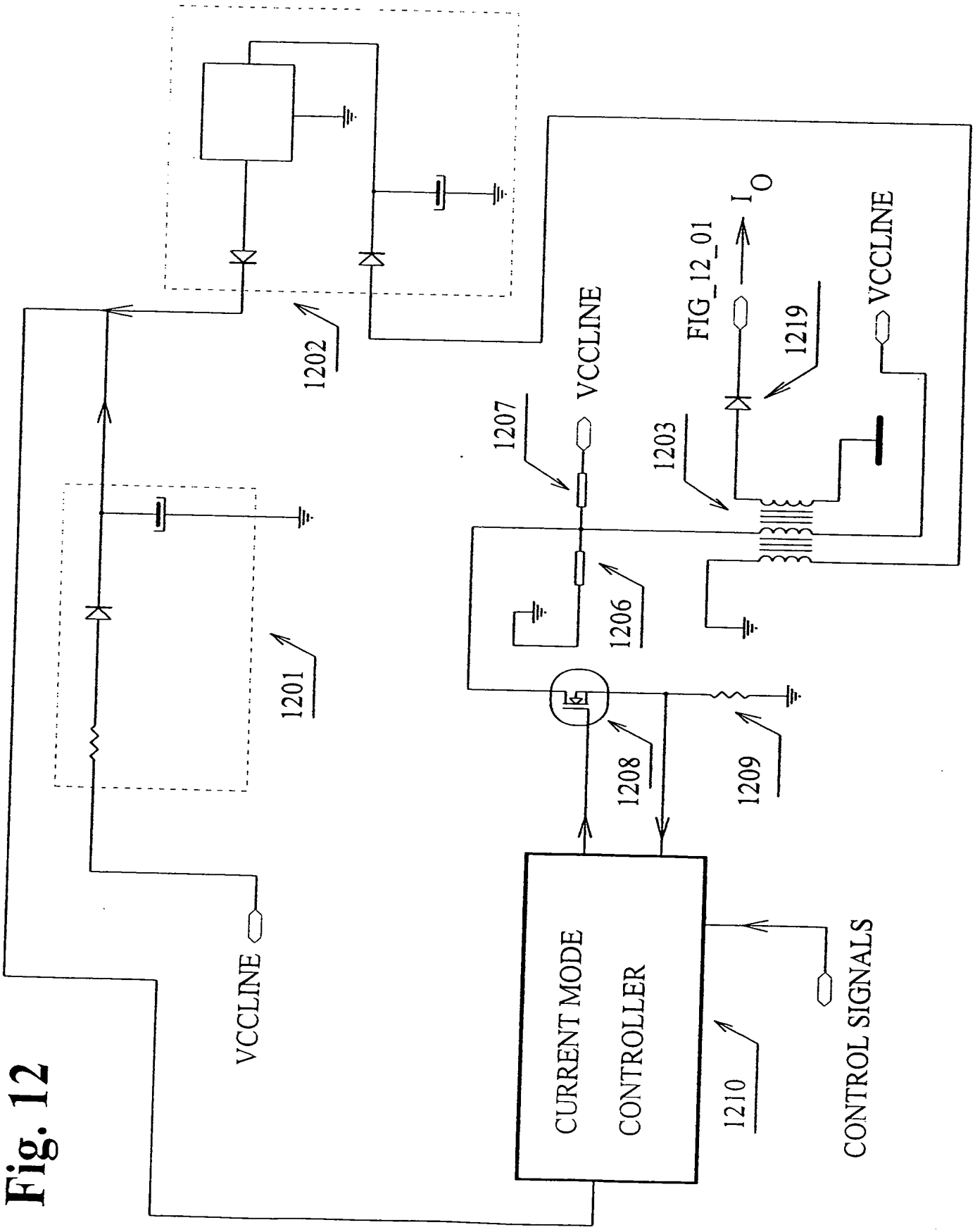

1202
VCCLINE
1207
1203
FIG_12_01
I_O
1219
VCCLINE
1201
1206
1208
1209
VCCLINE
CURRENT MODE
CONTROLLER
1210
CONTROL SIGNALS

Fig. 12

Fig. 12 (CONT'D)

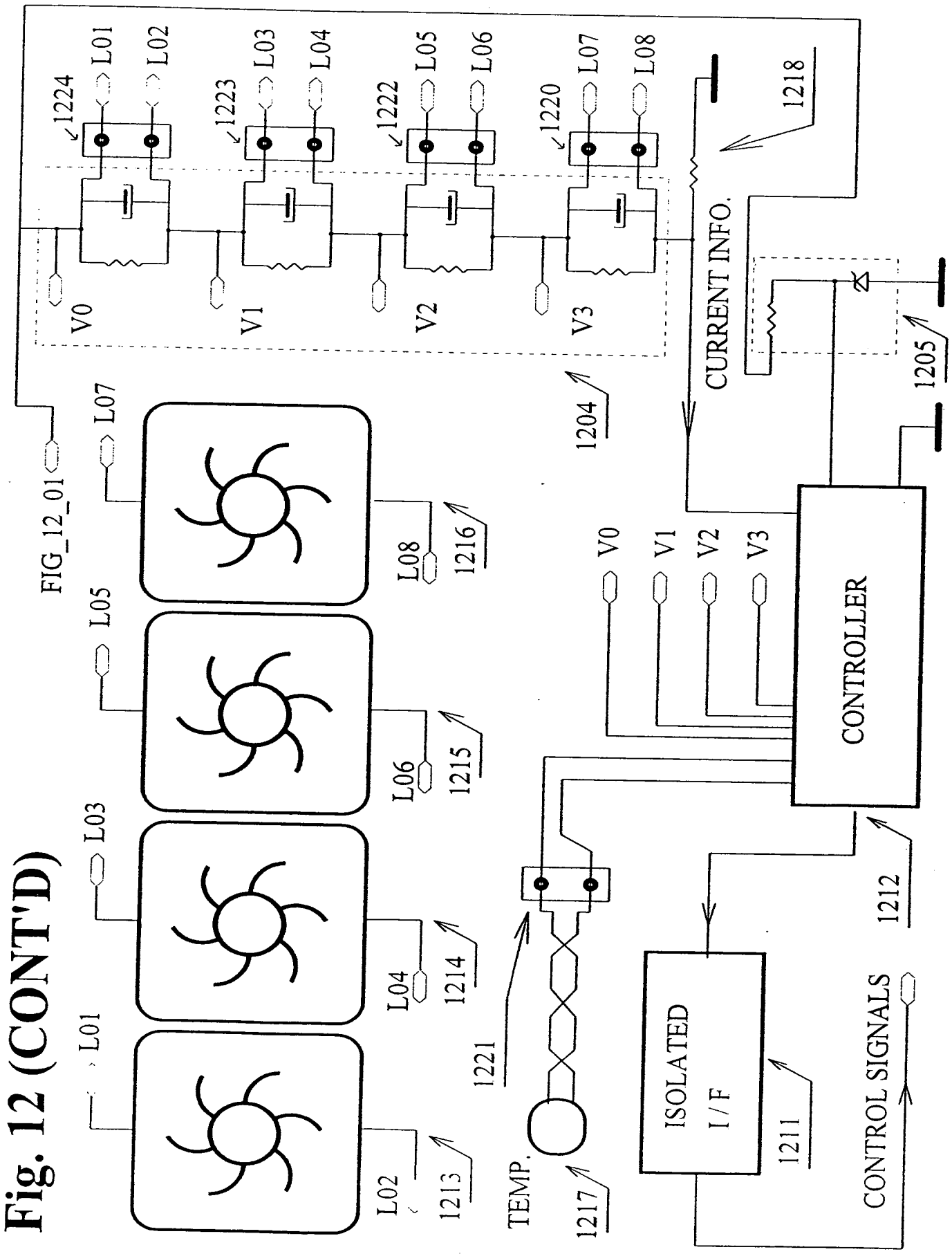


FIG_12_01
L01
L02
L03
L04
L05
L06
L07
L08
1213
1214
1215
1216
1217
1218
1220
1221
1222
1223
1224
1204
1205
1211
1212
V0
V1
V2
V3
TEMP.
CURRENT INFO.
CONTROLLER
ISOLATED
I / F
CONTROL SIGNALS

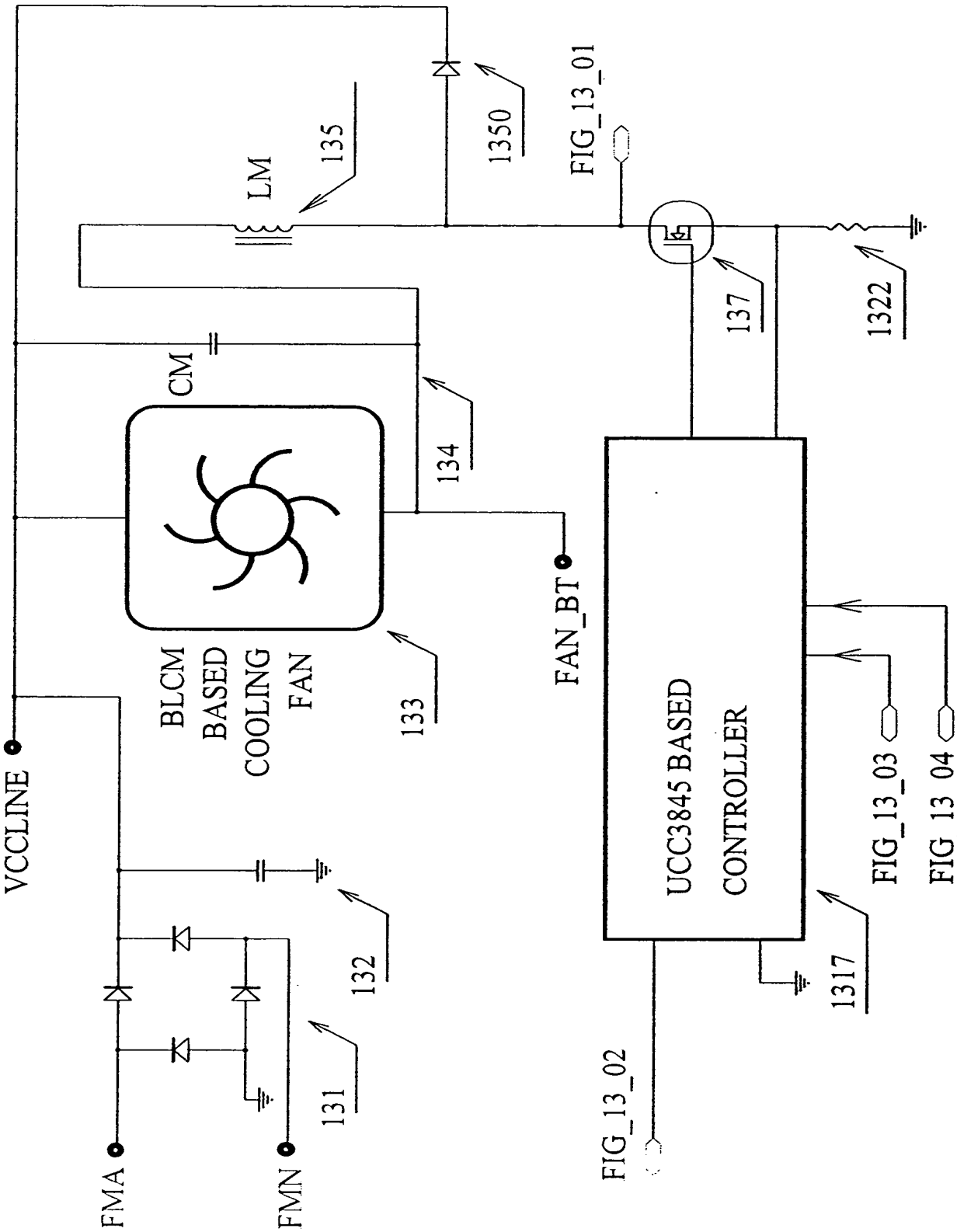

VCCLINE
FMA
FMN
131
132
133
134
135
LM
CM
BLCM BASED COOLING FAN
1350
FIG_13_01
137
1322
FAN_BT
UCC3845 BASED CONTROLLER
1317
FIG_13_02
FIG_13_03
FIG_13_04

Fig. 13

Fig. 13 (CONT'D)

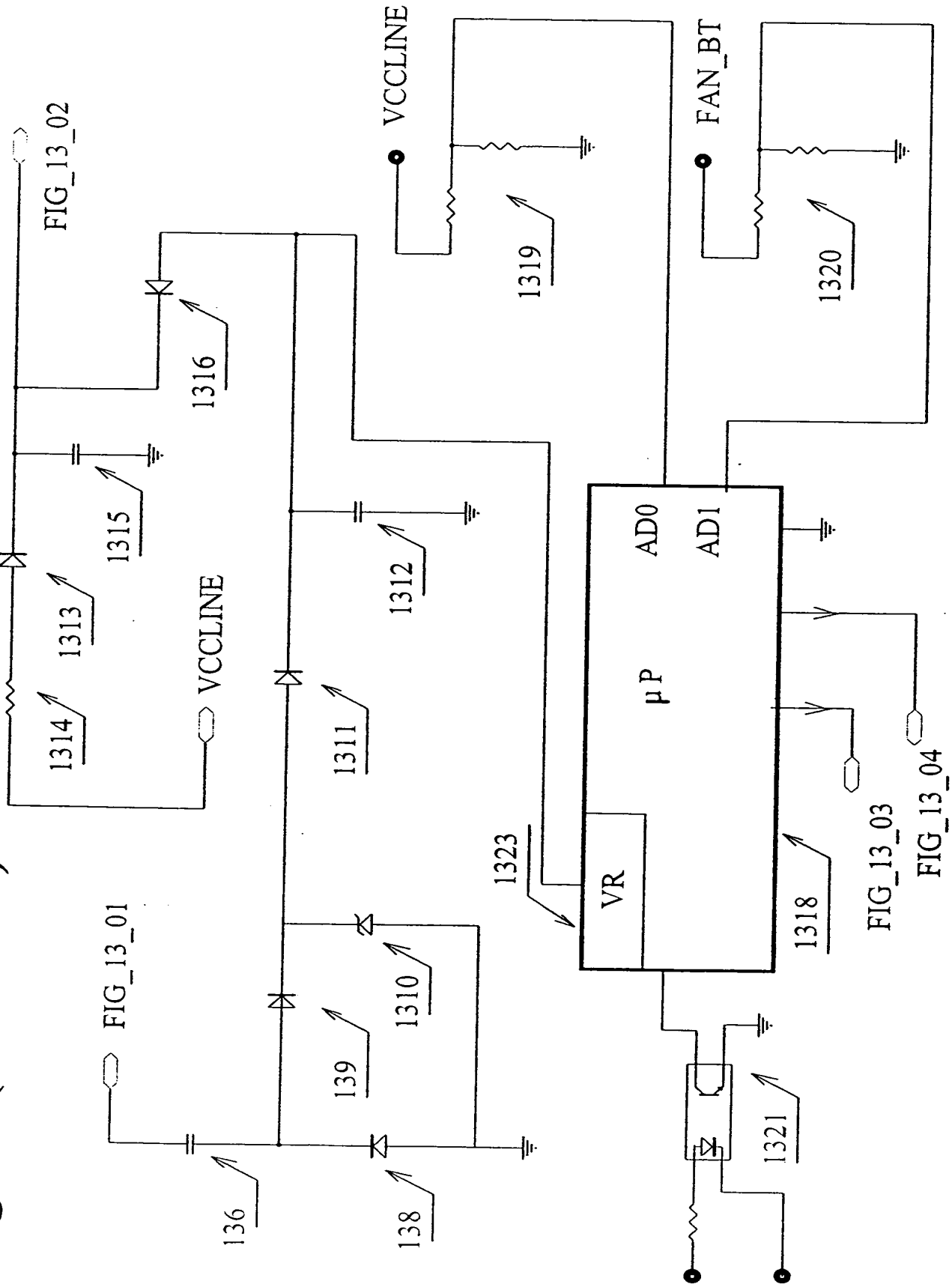


FIG_13_02
VCCLINE
FAN_BT
1319
1320
1316
1315
1313
1314
VCCLINE
1312
1311
AD0
AD1
μP
1323
VR
1318
FIG_13_03
FIG_13_04
FIG_13_01
139
1310
1321
136
138

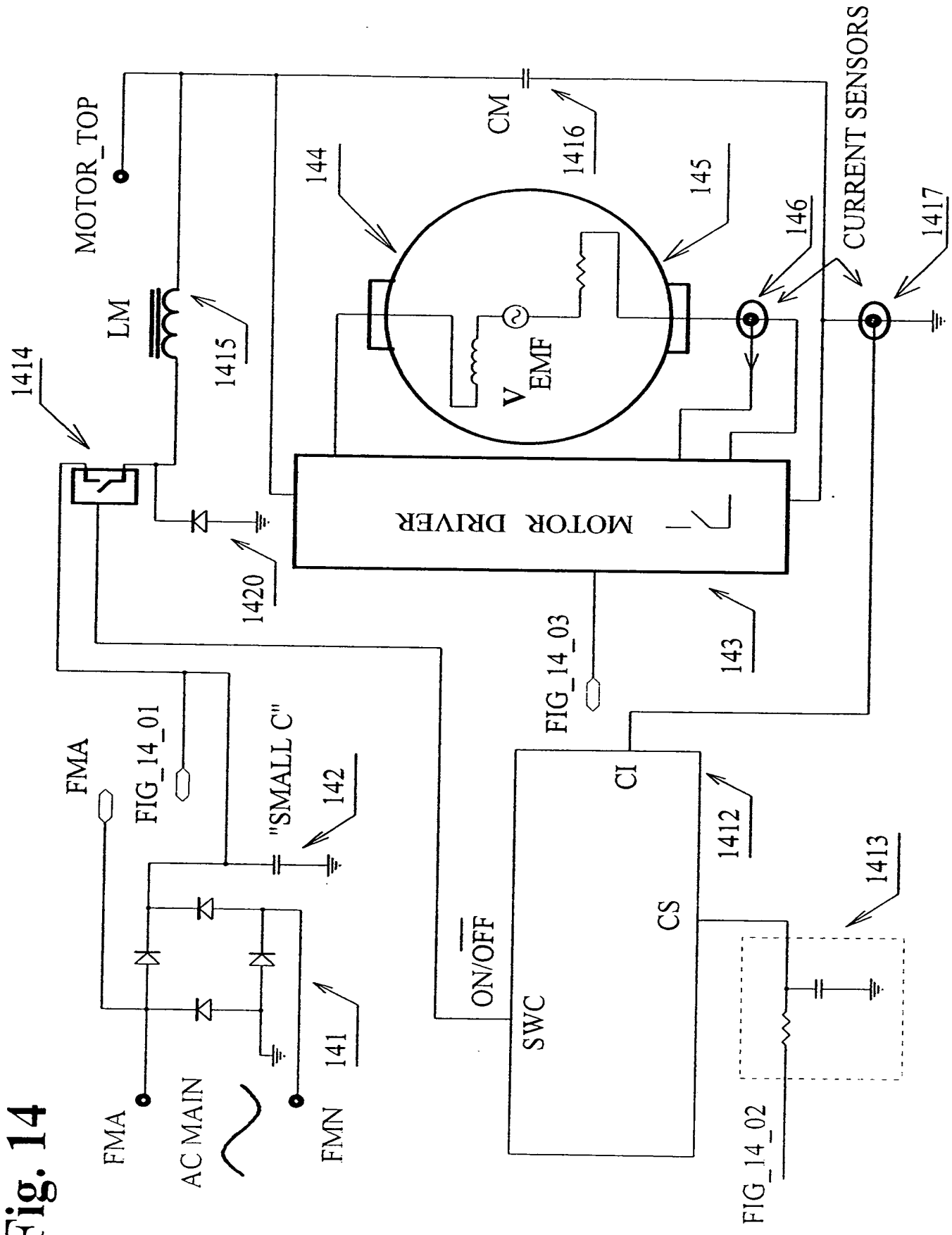

MOTOR_TOP
LM
1415
1414
1420
MOTOR DRIVER
144
145
CM
1416
146
CURRENT SENSORS
1417
V EMF
143
FIG_14_03
FMA
FIG_14_01
"SMALL C"
142
141
FMA
AC MAIN
FMN
ON/OFF
SWC
CI
CS
1412
1413
FIG_14_02

Fig. 14

Fig. 14 (CONT'D)

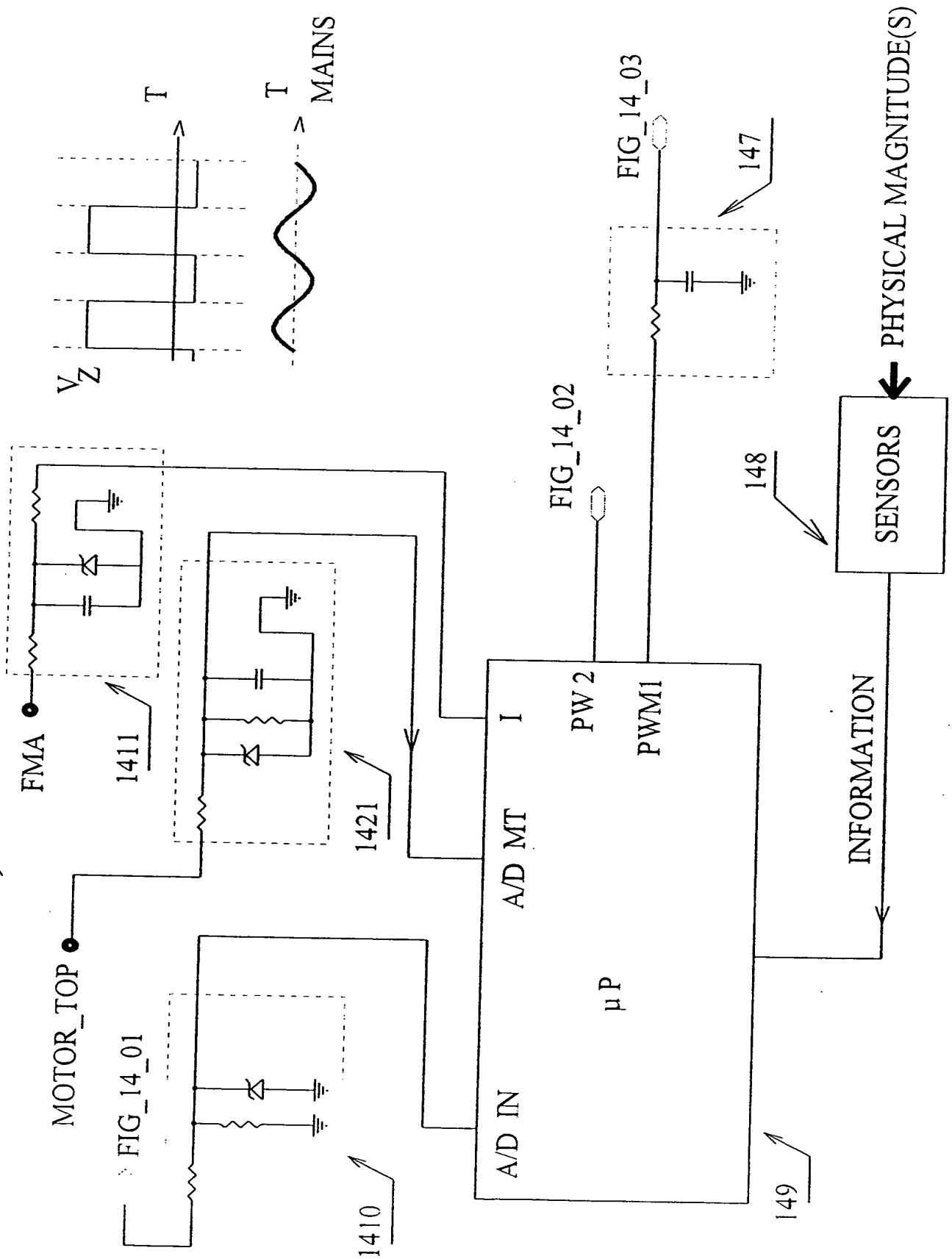
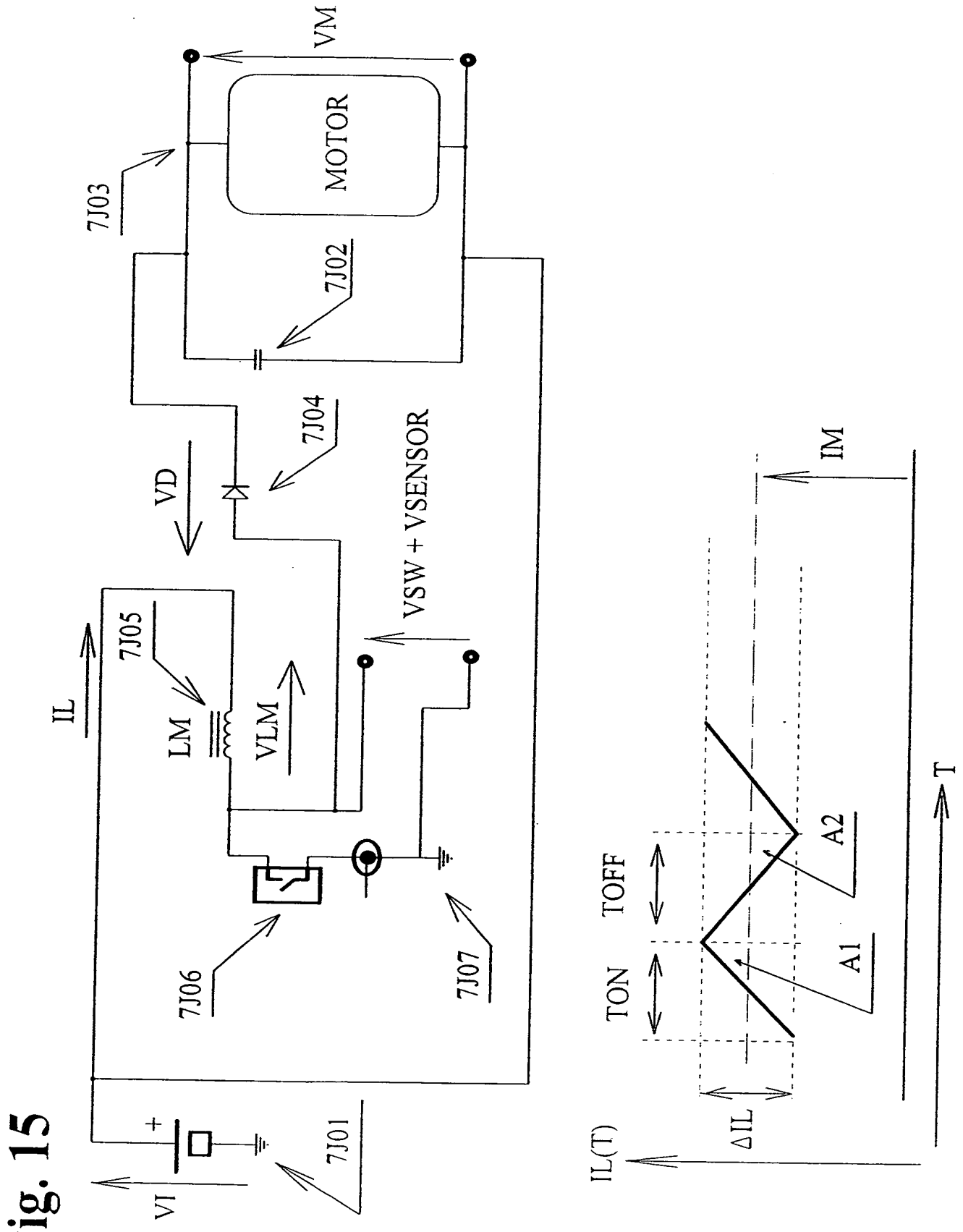

T
T
MAINS
V_Z
FIG_14_03
147
FIG_14_02
148
SENSORS
PHYSICAL MAGNITUDE(S)
FMA
1411
1421
MOTOR_TOP
FIG_14_01
1410
A/D IN
A/D MT
I
PW 2
PWM1
µ P
INFORMATION
149

Fig. 15


VM
MOTOR
7J03
7J02
7J04
VD
VSW + VSENSOR
IL
7J05
LM
VLM
7J06
7J07
VI
7J01
IM
TOFF
TON
A2
A1
ΔIL
IL(T)
T

$$(1501)\ V_M \cong I_M \cdot R_M + Vemf$$

$$(1502)\ Vemf = Kv \cdot \omega M$$

$$(1503)\ Vsw + V_{SENSOR} << V_L$$

$$(1504)\ V_D << V_M$$

$$(1505)\ \Delta I_L = \frac{V_I}{L_M} \quad T_{ON} = \frac{V_M}{L_M} \quad T_{OFF}$$

$$(1506)\quad \frac{T_{ON}}{T_{OFF}} = \frac{V_M}{V_I}$$ (FOR CONTINOUS CONDUCTION MODE)

Fig. 15 (CONT'D)

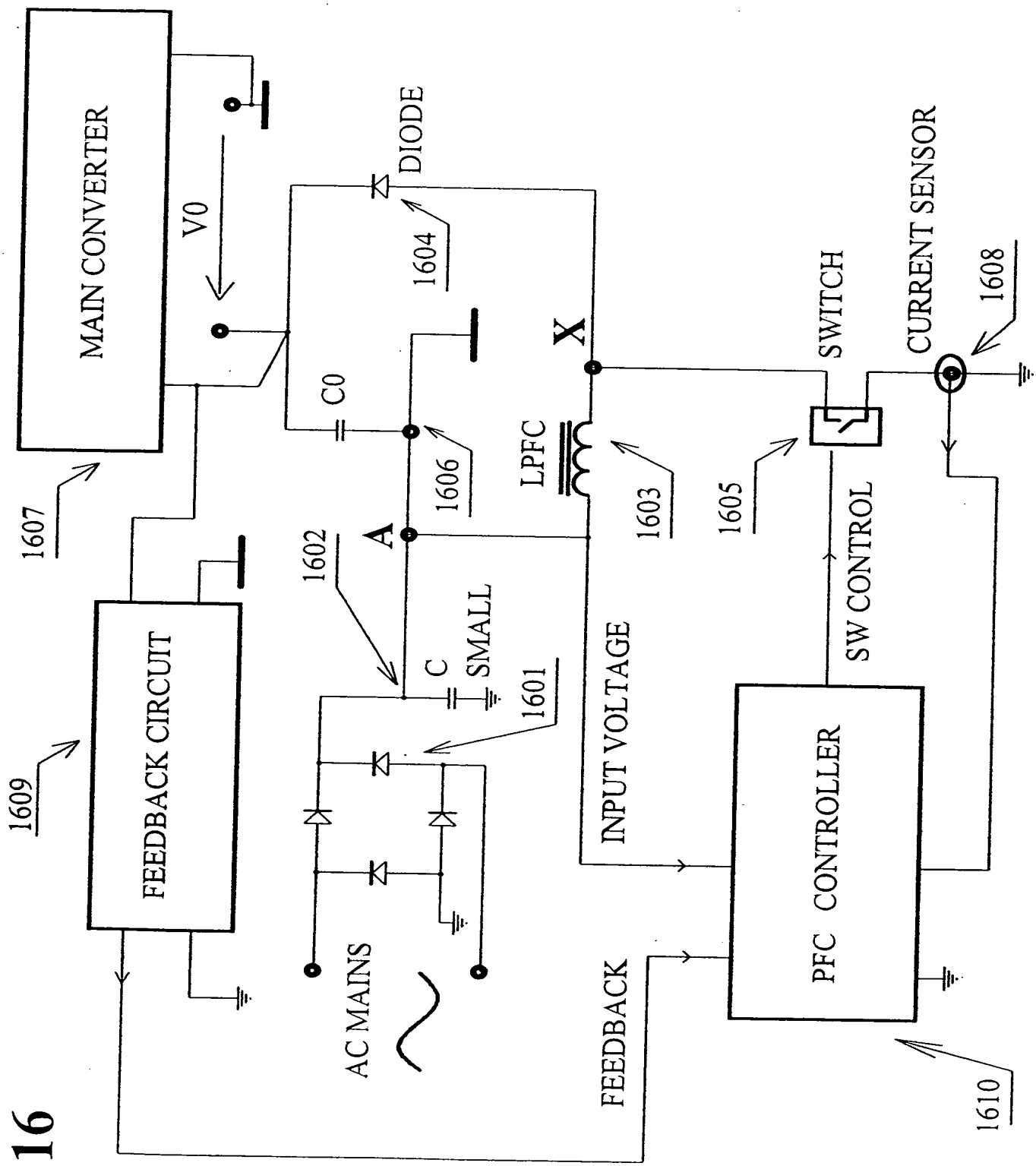

MAIN CONVERTER
V0
DIODE
1604
C0
1606
LPFC
X
SWITCH
CURRENT SENSOR
1608
1607
A
1602
1603
1605
SW CONTROL
C
SMALL
1601
INPUT VOLTAGE
1609
FEEDBACK CIRCUIT
AC MAINS
FEEDBACK
PFC CONTROLLER
1610

Fig. 16

Fig. 17A

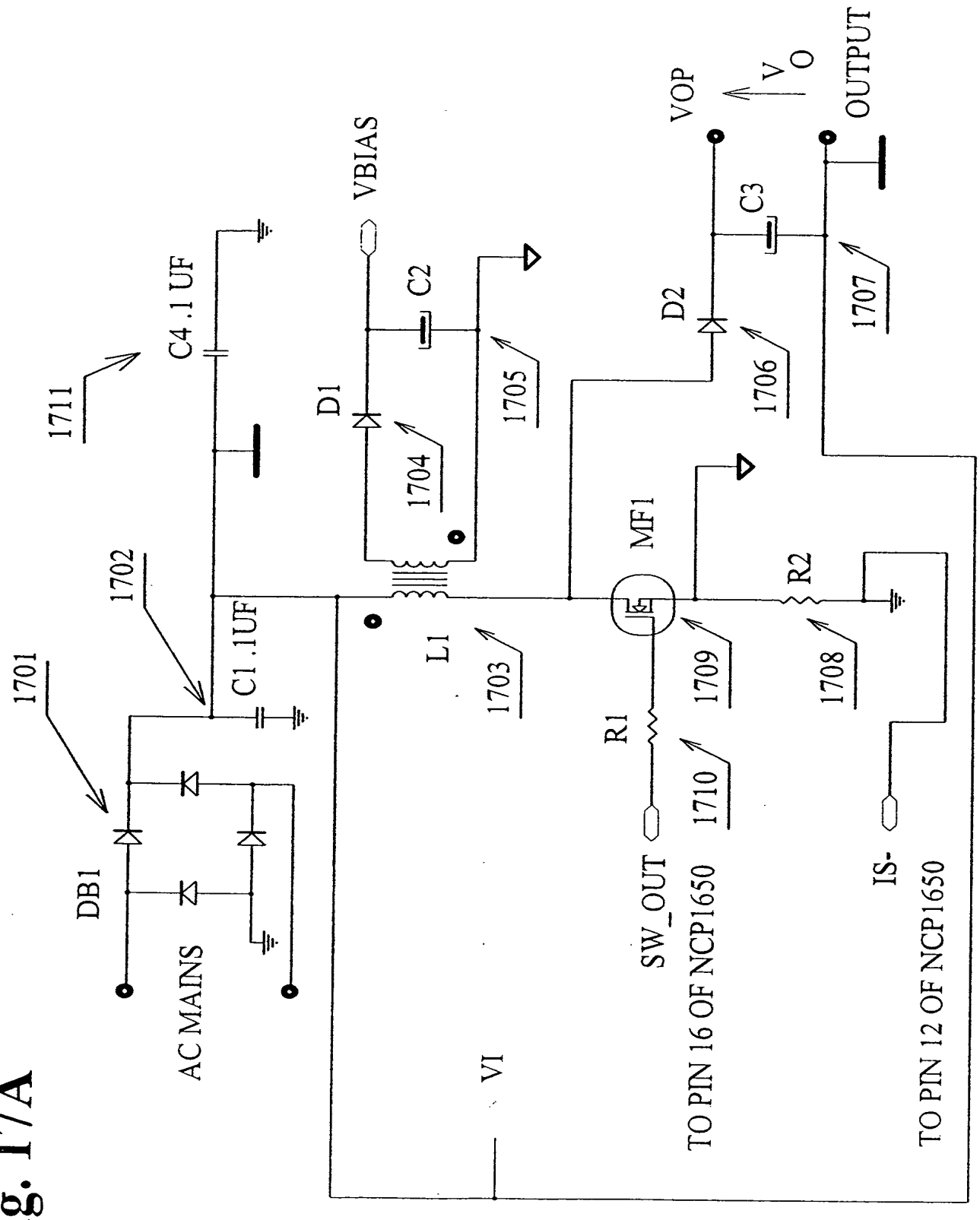

1701
DB1
AC MAINS
1702
C1 .1UF
1711
C4 .1 UF
VBIAS
C2
D1
1704
1705
L1
1703
MF1
R1
1709
1710
SW_OUT
TO PIN 16 OF NCP1650
R2
1708
IS-
TO PIN 12 OF NCP1650
VI
D2
1706
VOP
C3
1707
OUTPUT
V
O

Fig. 17B

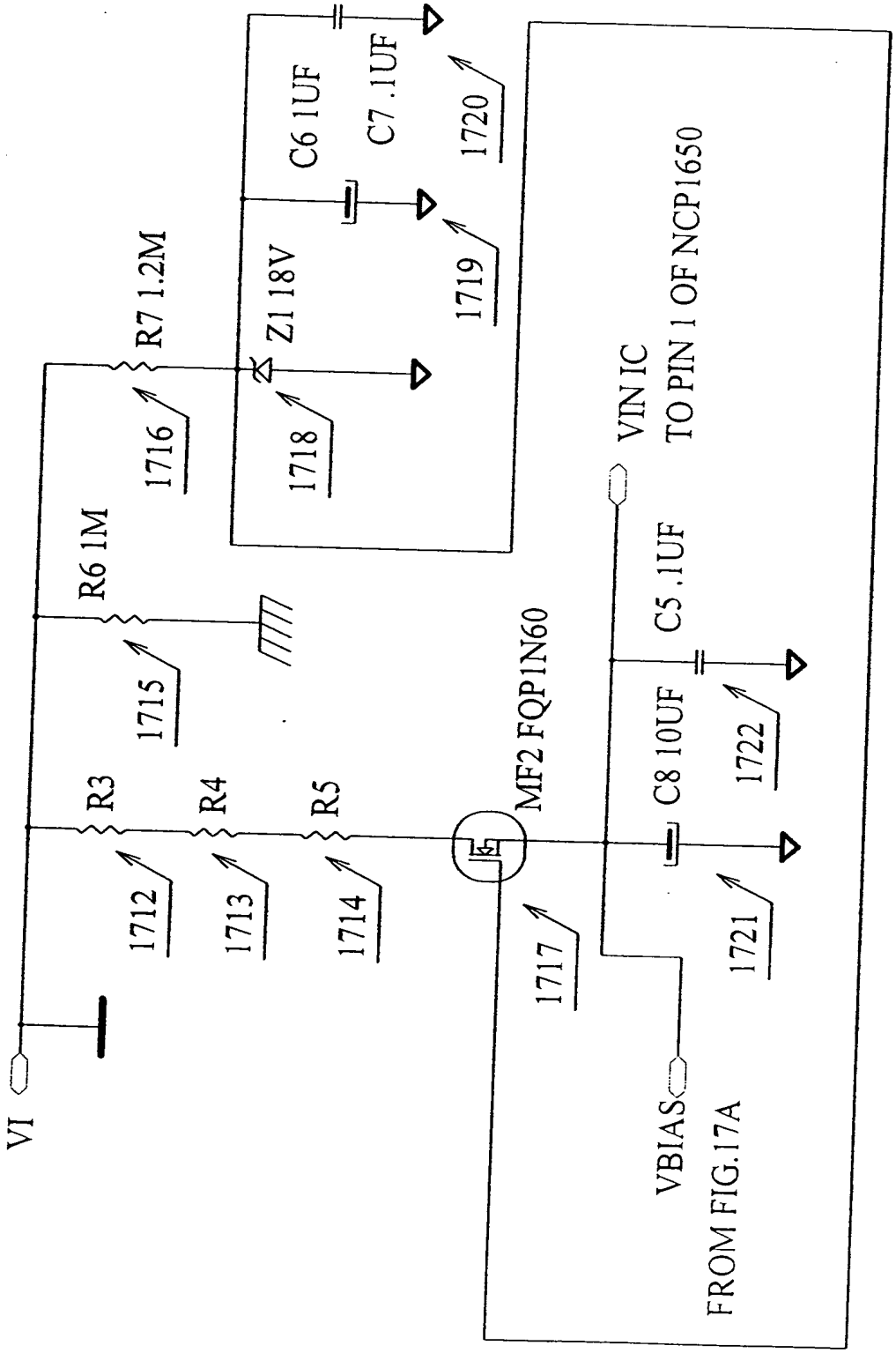
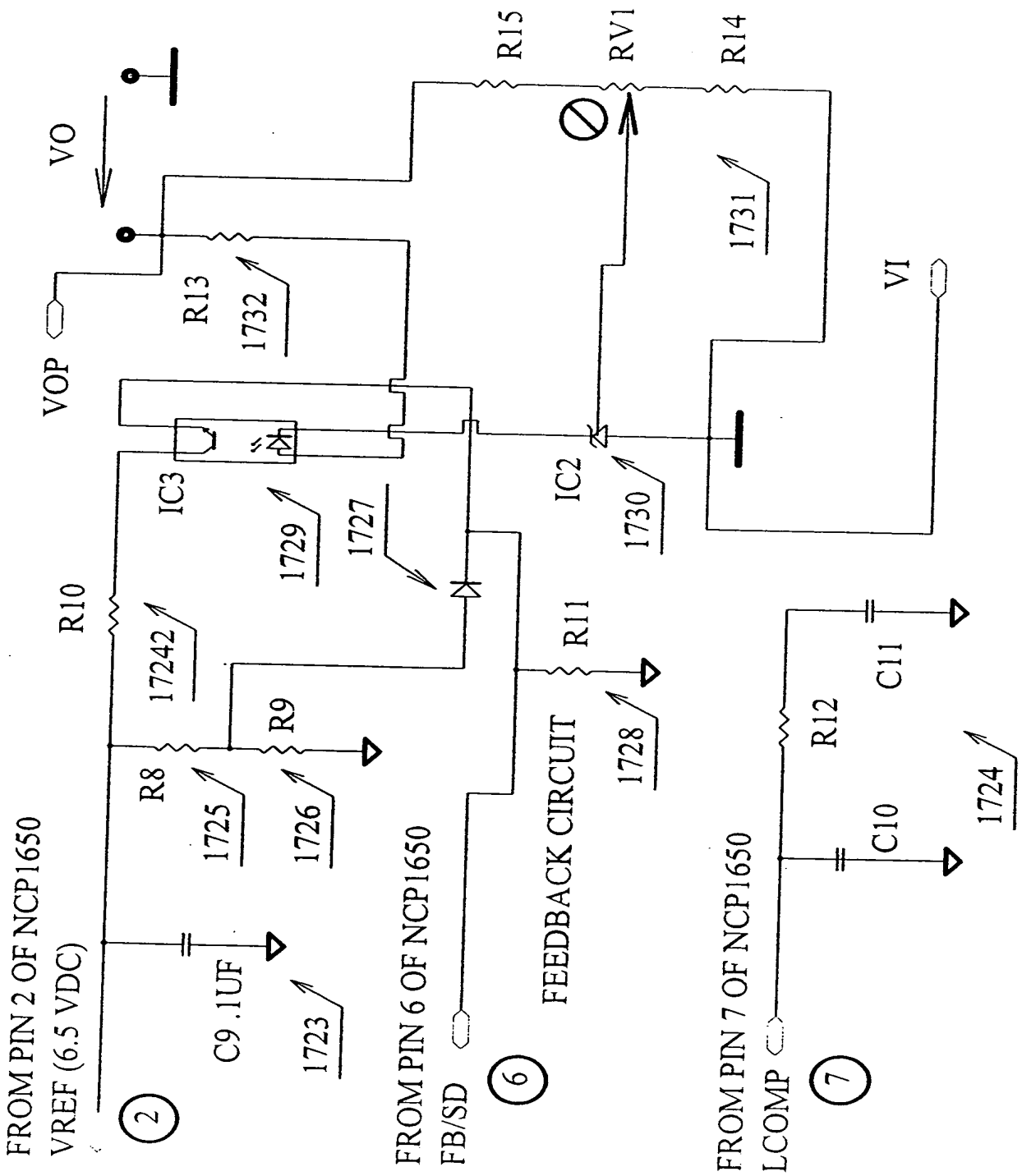

VI
R3
R4
R5
R6 1M
R7 1.2M
Z1 18V
C6 1UF
C7 .1UF
C5 .1UF
C8 10UF
MF2 FQP1N60
VIN IC
TO PIN 1 OF NCP1650
VBIAS
FROM FIG.17A
1712
1713
1714
1715
1716
1717
1718
1719
1720
1721
1722

Fig. 17C


VO
VOP
R13
1732
R15
RV1
R14
1731
VI
IC3
IC2
1729
1727
1730
R10
17242
R11
R8
1725
R9
1726
1728
C9 .1UF
1723
C11
R12
C10
1724
FROM PIN 2 OF NCP1650
VREF (6.5 VDC)
2
FROM PIN 6 OF NCP1650
FB/SD
6
FEEDBACK CIRCUIT
FROM PIN 7 OF NCP1650
LCOMP
7

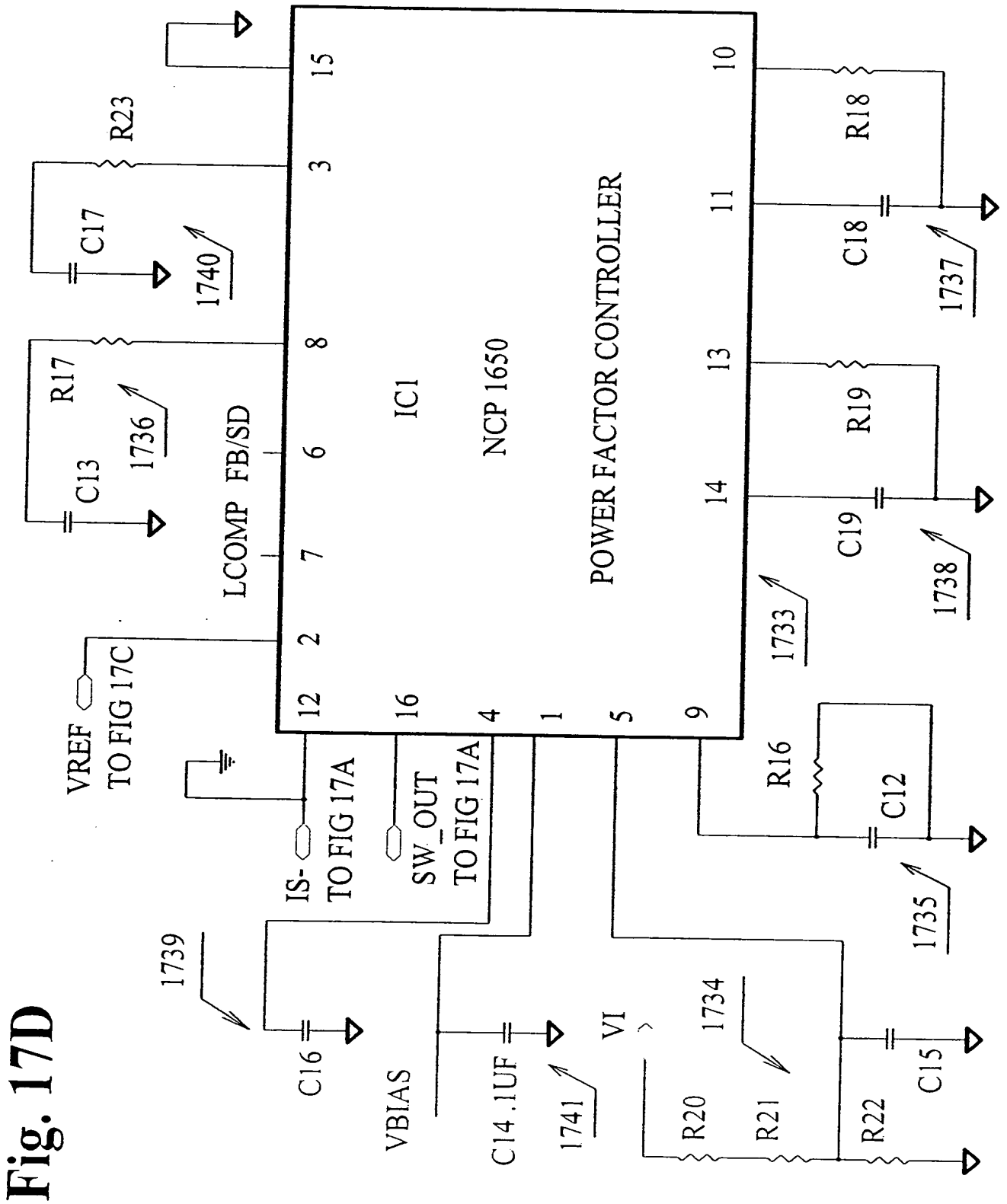

IC1
NCP 1650
POWER FACTOR CONTROLLER
LCOMP
FB/SD
VREF
TO FIG 17C
IS-
TO FIG 17A
SW_OUT
TO FIG 17A
VBIAS
VI
R23
R17
R16
R18
R19
R20
R21
R22
C17
C13
C12
C18
C19
C16
C14 .1UF
C15
1739
1740
1736
1733
1737
1738
1735
1741
1734
1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
16

Fig. 17D

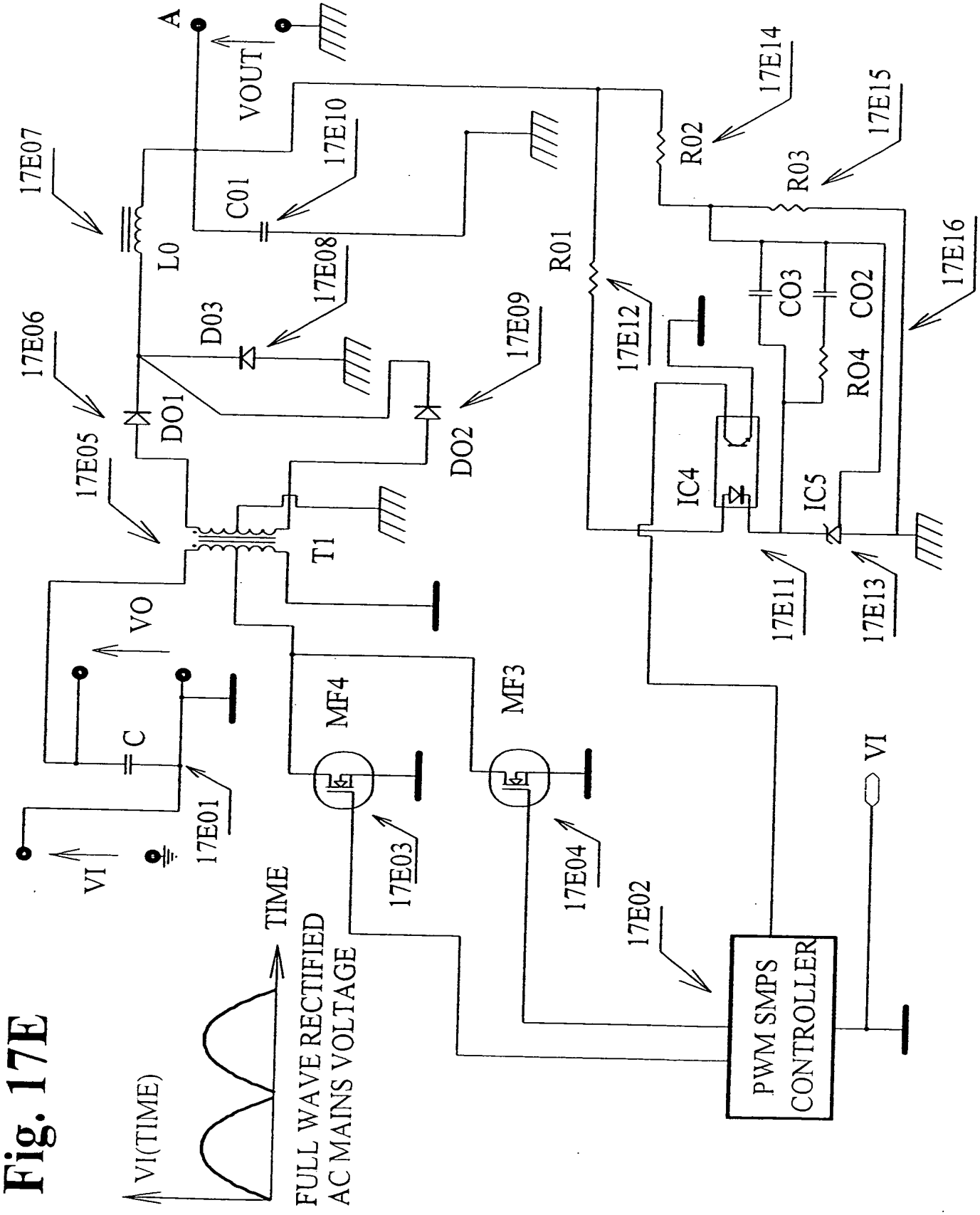
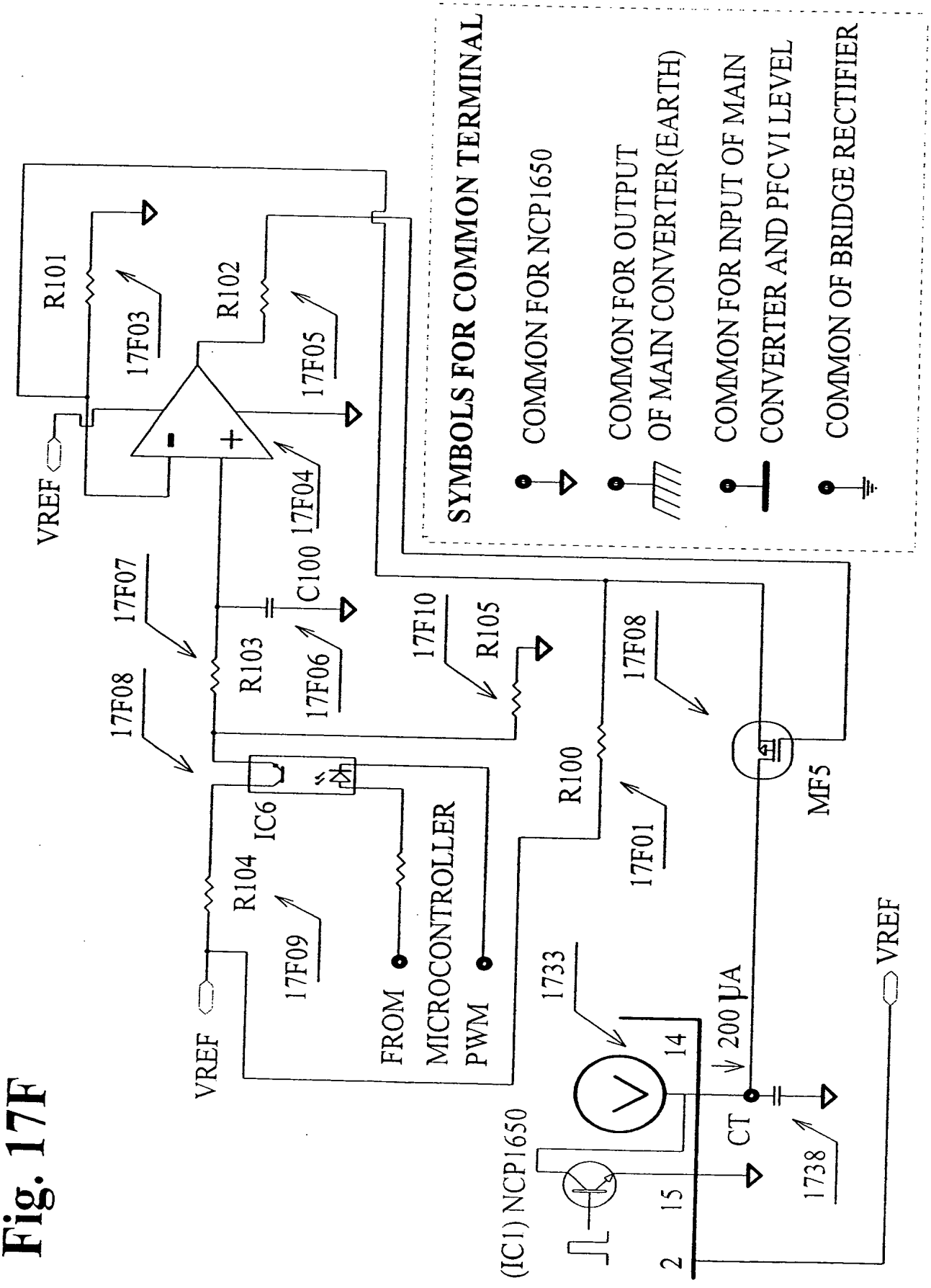

A
VOUT
17E07
17E10
C01
L0
17E08
D03
17E06
DO1
17E05
T1
17E09
DO2
R01
17E14
R02
17E15
R03
17E16
CO3
CO2
RO4
17E12
IC4
IC5
17E11
17E13
VO
C
17E01
VI
MF4
MF3
17E03
17E04
17E02
PWM SMPS CONTROLLER
VI
TIME
VI(TIME)
FULL WAVE RECTIFIED AC MAINS VOLTAGE

Fig. 17E

Fig. 17F


SYMBOLS FOR COMMON TERMINAL
COMMON FOR NCP1650
COMMON FOR OUTPUT OF MAIN CONVERTER (EARTH)
COMMON FOR INPUT OF MAIN CONVERTER AND PFC VI LEVEL
COMMON OF BRIDGE RECTIFIER
VREF
R101
17F03
R102
17F05
17F04
C100
17F07
17F08
R103
17F06
17F10
R105
17F08
R100
17F01
MF5
IC6
R104
17F09
FROM MICROCONTROLLER PWM
VREF
1733
(IC1) NCP1650
2
15
14
200 µA
CT
1738
VREF